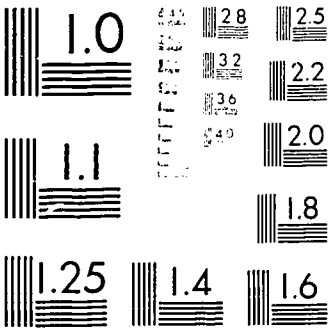

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ABSTRACT

This study was designed to 1) reasonably relate educational resources and the way they are used for specific students to the educational outcomes for those students, and 2) to demonstrate the feasibility and problems of obtaining information about resource-effectiveness relationships. Data for the study were gathered at Everett Junior High and Mission High School in the San Francisco Unified School District. Section 1 describes the objectives and development of the study; section 2 discusses the development of Everett Junior High School's learning centers and differences in the use of resources by each learning center; section 3 analyzes achievement test measures for Everett in light of the working hypotheses; and section 4 describes Mission High School's equal-cost route to increased school effectiveness. (Author/JG)

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May 1976

RESOURCE/EFFECTIVENESS RELATIONSHIPS IN EDUCATION: AN INTRA-SCHOOL, STUDENT-LEVEL APPROACH

Sue A. Haggart and Francois G. Christen

NIE-G-74-0027
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A WORKING NOTE
prepared for the
NATIONAL INSTITUTE OF EDUCATION

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PREFACE

This research was performed for the National Institute of Education under Grant No. NIE-G-74-0034. The purpose was to determine the feasibility of using an intra-school, student-level approach to investigate relationships between school resources and student outcomes.

The approach was based on the observation that previous studies of the effect of school resources used district-wide dollars per student as a measure of resources, apparently assuming all studies shared equally. It was contended that resource/effectiveness relationships would be unearthed only if different patterns of resource-use for particular groups of students could be identified, and if the outcomes (achievement measures) for these groups of students could be identified.

The San Francisco Unified School District agreed that two schools, Everett Junior High School and Mission High School, would participate in the investigation on a no-cost-to-the-District basis. The selection of these two schools was an outgrowth of earlier Rand work with the District on developing a model of school-site budgeting.

Several staff members from each school provided guidance, information and support throughout the study. For Everett, the principal, Mrs. Mariann Cotter, and Mr. Gregg Bender and Mr. Arthur Duffy were the primary participants. For Mission, the principal, Mr. Theodore Scourkes, and Mr. Robert Harrington and Mrs. Frances Twoniak provided the information for the study. Their assistance was invaluable and their enthusiasm was unlimited.

CONTENTS

I. INTRODUCTION

STATEMENT OF PROBLEM

The almost universally held opinion among the members of the educational community and those who seek to analyze the process of education is that in some way school resources must make a difference in student achievement. Parents support this opinion by residing in a school district with the highest expenditure per student, providing this residential choice is within their means. This is in spite of the fact that numerous studies have failed to supply a definite answer to the question, "Do school resources make a difference in student achievement?"

The purpose of this research is to explore different investigative means through which the relationships between resources and student achievement could be identified. The methodology itself and its data requirements are of particular interest. Equally important is the underlying objective of the research: To provide insights so that the question of whether or not school resources make a difference could be answered more effectively.

The underlying contention is that there have been a number of major deficiencies in past studies. Many of these studies have looked at resources in the aggregate of the district or the school and at average achievement for groups of students who may not have shared equally in the use of the resources. This mismatch of cause-and-effect measurement entities has contributed significantly to the ambiguous findings. Another major deficiency in past studies has been the neglect of the educational process--the area of how *resources are used*. The research strategy underlying this study deals explicitly with the problem of relating student use of school resources to achievement.

Over the years educational policymakers and researchers have used the cost per student as a proxy measure for school resources in the investigation of the relationship between expenditures and the quality of educational outcome. The implication is that the higher a state's

or district's expenditure of funds on a per-student basis, the better the quality of education in that state or district. This assumes that all students fare alike in exposure to the resources, makes no allowance for different needs for special students and neglects the contribution of factors that do not have a price tag. Each of these considerations must be taken into account if the relationships between resources and effectiveness are to be substantiated and used to improve the allocation of resources within the educational system.

RELATED STUDIES

Studies, using regression analysis, have attempted to relate the characteristics of resources, again not related to student use, to student outcome. In these studies, indicators of "quality" (teacher educational level, years of experience, number of library books) and other resource inputs were treated as the explanatory variables. The results of these studies present a mixed picture. It is possible to find support either for the position that resources do make a difference or for the position that resources make no difference.

The findings of past studies (pre-1973) on the relationship between resource inputs and educational outputs presented inconclusive findings and a rather dismal picture relative to the future. The review, presented in Appendix A, concluded that research to date has not demonstrated that school resources have a consistent and strong impact on educational outcomes. It was further concluded (1) that the difficulty might lie in the conceptual models on which past research had been based, and (2) that the problems of past research might provide the direction for more fruitful investigation. Specifically, it was felt that adjusting for the measurement mismatch (discussed previously) and decreasing the level of aggregation might open the research door to some answers.

The Coleman Report and Sequelae

The impregnable barrier erected by the Coleman Report* and its sequelae published by Coleman data reanalyzers has resisted assault

*Coleman, James S., et al., *Equality of Educational Opportunity*, U. S. Department of Health, Education and Welfare, U. S. Office of Education, Washington, D. C., 1966.

for many years. The primary assault in the late Sixties came from those who felt the microeconomic production function approach could be the successful weapon. Several years after these efforts to find the marginal change in output, there were several voices calling for a second look at the production function's appropriateness for education. Outstanding among these was Burkhead who had in 1967 espoused the approach.* In 1973, however, he expressed the following reservation:

> Apart from the data problems, which will continue to be serious, there are also some conceptual difficulties in the microeconomic analysis of education. In the estimation of production functions in the private sector, it is assumed that a factory manager, for example, has reasonably good knowledge of the marginal productivity of the factors that he utilizes, and thus he is able to optimize factor combinations to maximize profit. But in elementary and secondary education there is no reason to assume that a school principal or district superintendent or board of education has knowledge of or interest in the marginal productivity of resource inputs. Even if these were known, it could not be assumed that it would be possible to secure least-cost combinations, given the institutional rigidities of mandates and conventional practice. Neither is there a reasonable substitute for the objective function of profit maximization. Thus the optimization rationale that underlies production functions in the private sector is inapplicable for elementary and secondary education.**

Levin, in 1971, observed that "very little theoretical or empirical work has been done on a very important aspect of educational production functions, that of seeking estimates of the maximum output that can be produced with a given set of inputs."*** He proposed a standard constrained-maximum model that would develop production functions for

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*Burkhead, Jesse, *Input and Output in Large City High Schools*, Syracuse University Press, Syracuse, New York, 1967.

**-----, *Economics Against Education*, Teachers College Record, December 1973, pp. 193-205.

***Levin, Henry M., *Frontier Functions: An Econometric Approach to the Evaluation of Educational Effectiveness*, Stanford Center for Research and Development in Teaching, Research and Development Memorandum, No. 80, November 1971.

schools. Thus, the production function still loomed large in the background but its analytical focus was changed from the student to the student in the school. As he states: "Emphasis is on assessing the input-output relations for *schools* that appear to be maximizing educational outcome"--that is, operating at the frontier--and for schools that appear to be average in efficiency. The same problem of usefulness of the results, given the realities of practice, identified by Burkhead still exists. Moreover, Levin continued to concentrate on the manipulation of *inputs* without regard to *student exposure to resources*.

[The index of school effectiveness proposed by Levin initially seemed as if it would be worth experimenting with in this research. The purpose was to explore some of the difficulties (e.g., data availability) encountered in actually trying to develop the school index. But given the limitations discussed above, the researchers had only a moderate curiosity about the index as a policy input in comparing several schools. This exploration was dismissed early in the research mostly because the results using only two schools would not be relevant to the research, and partly because the data were not readily available. Also, a closer look at the magnitude of the data collection task placed such an effort well beyond the resource limits of this research.]

New York, Philadelphia, and Michigan Studies

Several more recent studies, however, offer the hope that school resources do, in fact, make a difference in student outcomes, namely achievement. These include (1) the State of New York's case study of factors affecting reading achievement in two matched inner city schools,* (2) Summers and Wolfe's research in the Philadelphia School District,**

*New York State's Office of Education Performance, *School Factors Influencing Reading Achievement: A Case Study of Two Inner City Schools*, State Capitol, Albany, New York, March 1974.

**Summers, Anita A. and Barbara L. Wolfe, *Which School Resources Help Learning: Efficiency and Equity in Philadelphia Public Schools*, February 1975. Federal Reserve Bank of Philadelphia Business Review, and also the technical version, *Equality of Educational Opportunity Quantified: A Production Function Approach*.

and (3) Education Turnkey Systems' cost-effectiveness study of Michigan's compensatory reading programs.*

The New York study looked at variables under the control of the school while holding the socioeconomic and ethnic characteristics of the schools constant. The Philadelphia and Michigan studies both consider a large number of variables *describing* the school and students and a smaller number relative to the quality of resources; neither study does an adequate job of specifying the process variables or student exposure to the resources. Moreover, the Michigan study used a cost per pupil as one measure of program resources and average achievement gain as the outcome measure. The Philadelphia study by Summers and Wolfe, on the other hand, did look at the process to some extent, stating "methods...[were] selected to get at this question of interaction between school input and type of pupil." The Philadelphia study, however, fell into the "average" trap on both the input and output measures. This, in spite of their statement that... "perhaps many negative findings on the effectiveness of school resources emerged because these averages [e.g., average experience levels of teachers in the school] disguised the true impact." Summers and Wolfe go on to state, in apparent seriousness: "Averaging allows the negative effects to offset the positive ones."

In spite of these shortcomings, the three studies do represent cracks in the Coleman-initiated barrier and do provide guidance for future researchers. An especially intriguing endeavor would be to reanalyze the Summers and Wolfe data on an intragrade basis, assuming their raw data would support such a focus. This focus would permit an emphasis on the student-teacher interaction level of the classroom or a subset of classrooms.

In sum, the examination of past studies reveals that resources apparently do not make a difference when (1) the resources are measured

*Michigan State Department of Education, *Executive Summary of 1973-74 Michigan Cost Effectiveness Study*, provided to the State Board of Education, September 1974. Based on an unreleased "Report on the Preliminary Results of the Cost-Effectiveness Study of Michigan Compensatory Education Programs" by Charles Blaschke and John Sweeney of Education Turnkey Systems, Inc., Washington, D. C.

as expenditures per student on a district or school basis, (2) the resources are measured as the physical quantity of items purchased, or (3) the difference is measured solely on the average achievement test scores for groups of students.

It could be demonstrated that resources make a difference if (1) the qualities of resources are also measured, (2) the different ways in which resources are used can be related to outcome, and (3) outcome is defined as other than average achievement gain.

RELEVANCE TO POLICYMAKING

A greater understanding of what resources are needed in order to achieve the desired educational outcome is an essential ingredient of policymaking. Decisions about the direction of research, the equity of alternative financing mechanisms, the allocation of resources, and the utilization of technology have to be based on more adequate information about what works and what does not work, under what conditions and for what students, and at what cost.

The resource-effectiveness relationships, quantified or even qualitatively identified with the help of the research strategy, provide information about what works. Just as what works can be implemented in education, what does not work can be analyzed to determine why not and to identify ways to change the process. Educational research, even though closely tied to the operational level of the classrooms and its student-teacher interaction, demands a broader look at the system as a whole. The characteristics of the instructional process must be described in order to determine the resource-effectiveness relationships. This description can be used in the process of educational research; as the resource-effectiveness relationships are known for a given event, variations can be generated and subjected to further research. The resource-effectiveness relationships then serve as directional guides to the more productive areas of research.

In the area of educational research, perhaps the more important use of the resource-effectiveness relationships involves the dissemination of the results of the more effective innovative programs. The dissemination can be more efficiently achieved because the resource-

impact information conveys to the potential user *more about what resources and what processes were used to produce the outcome*, given the specific conditions and characteristics of the students. Thus, the policymaker gains considerably more information than if he were provided with only the cost per student to achieve the outcome.

In assessing the educational equity of alternative financing mechanisms, knowledge of the different resource needs for typical as opposed to exceptional students is a vital element in the policymaking function. The resource-effectiveness relationships present this information in an organized manner. In addition, as more can be said about the impact of alternative resource utilization for different types of students, the probability of providing equal educational opportunity increases.

Educational planning for the more effective use of resources obviously depends on knowledge of the resource-effectiveness relationships. The development of these relationships demands information about the specific resources, the nature of their use and the resulting outcome. All of this information is needed in improving the effectiveness of resource allocation--a consideration that becomes even more important as the legislators and the taxpayers are, in effect, saying to the educational policymaker, this is the limit--look for lower cost methods to achieve the same effectiveness.

Technology has long been thought of as a potential way to improve the quality of education within a reasonable cost. One of the problems in evaluating this potential has been that not enough is known about the conventional methods--there is no way to compare the technology-based method with the conventional, as a substitute not a supplement. This last distinction is important because most of the studies of technology in education have examined the cost (and sometimes, the effectiveness) of supplementing conventional instruction.

Changes in education are effected at the classroom level and at the student level. The direction and magnitude of these changes have to be determined. The resource-effectiveness relationships derived from this information become strong inputs to the decisionmaking process at the school and district levels.

RESEARCH STRATEGY

The basic premise of this research is that resource-effectiveness relationships can be identified only if the student use of resources can be defined and the outcome for *these* students can be measured. This rules out the traditional district-wide cost per student as an indicator of resource input and the grade-level achievement *gain* as a measure of outcome. Three learning situations for student exposure to different combinations of resources and different instructional strategies are identified. Measures of student performance for these students are available.

The research strategy is designed to counter the past practice of neglecting the instructional process variables and student exposure to resources. In addition, it addresses the task of being sufficiently *descriptive* and *qualitative* in analyzing the impacts of resource use so that *broad and yet definitive relationships* can be determined. The objective is not to determine a single relationship of the nature, "More of X yields more of Y." The policy relevance of a statement in the Summers and Wolfe study..."As one more book per pupil is added to the library, pupil achievement growth declines by .5 months."*--is rather dubious to say the least. But its presence points, in part, to the need for reasonable interpretation of the results of statistical manipulation and in part to the need for better specification of the use of resources. Perhaps a more vital observation is that number neatness, per se, is not as important as developing more gross "signals" of trends or relationships that may subsequently be subjected to a more precise analysis. The research strategy also is designed to make the best use of available data. The belief is that a commonsensical approach will open avenues of investigation thus far closed and will more than offset an acknowledged lack of statistical rigor, certain to be criticized by some.

The objectives of the study are: (1) to reasonably relate resources and the way in which they are used for specific students to the outcomes achieved for those students, and (2) to demonstrate the

*op cit, p. 24.

feasibility and problems of obtaining usable information about the resource-effectiveness relationships.

As originally proposed the research approach assumed that it would be possible to collect data on resources, alternative uses of resources and student outcomes at the program or classroom level. The assumption was based on past experience in evaluating specific educational programs and on the methodologies of resource analysis, achievement score analysis, and cost-effectiveness analysis tailored to the evaluation needs of these educational programs.* Subsequent experience led to the observation that the dollar measures of alternative programs were relatively insensitive to variations in the presence or use of low-cost instructional equipment and materials. (This excludes, of course, the high capital cost systems of educational television and computer-assisted instruction.) In addition, it was observed that in the regular instructional programs, by grade within the school, all used more or less of the same resources. The result, for the research strategy of this study, was a shift in emphasis. The alternatives were described in terms of the organization of the instructional process. The intensity of instructional aide use, the planning time of the teachers, and the grouping of students became the variables of interest.

The change in emphasis also reflects the realities of data availability. The research proposed a within-school approach. The schools selected, Everett Junior High School and Mission High School of the San Francisco Unified District, seemed to present ready-made alternative uses of resources. (See the letter from the participating district in Appendix B.) The early stage of this research was devoted to identifying working hypotheses and the availability of the data to support their investigation. For Everett, this hypothesis-identifying effort was moderately successful.

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*These methodologies are delineated in several publications, including *Educational Program Cost Analysis*, S. A. Haggart, P-4744, *Idiographic Analysis of Achievement Measures*, M. L. Rapp and S. A. Haggart, P-4880, and *Increasing the Effectiveness of Educational Demonstration Programs*, S. A. Haggart and M. L. Rapp, R-1120, all from The Rand Corporation, Santa Monica, California.

The overarching hypothesis is that school resources make a difference in student achievement if student exposure to alternative instructional situations (combinations of resources) can be determined. The working hypotheses at the junior high level are:

- o Changes in the 7th and 8th grade instructional organization at Everett Junior High School had discernible, positive effects on the academic performance of those students in the 9th grade.
- o Some feeder elementary schools, using approximately the same quality and quantity of resources, and having students with relatively the same socioeconomic status (SES), ethnic distribution, mobility factor, and mix of academic capability will "produce" students who do better in the 7th-grade core academic subjects (reading and arithmetic) than the students from other feeder elementary schools.

The second working hypothesis--some elementary feeder schools "produce" students who perform better in the 7th-grade core academic subjects than students from other feeder schools--was generated as a result of the intuitions of the 7th-grade faculty. The hypothesis is pursued because, if the phenomenon of differing quality of performance were, in fact, true, then there would be reasonable evidence that *how school resources are used* makes a difference. The next step would then be an investigation of the different ways in which the more successful schools used their resources. Finding the hypothesis substantiated would be the "signal" or directional guide to the more productive research areas as mentioned earlier.

As far as could be determined, Everett had not analyzed their incoming 7th-grade students by feeder school. The operating, and commendable, philosophy is that the school accepts the individual student "where he is" and works from that position on a student-by-student basis. That is all well and good. It seems that this phenomenon of differing quality of students among the feeder schools provides reasonable evidence that school resources and <u>how they are used</u> do make a difference. For the most part, the feeder schools and the accepting

schools are within the same attendance boundary and have student populations with the same socioeconomic, ethnic, home environment, and mobility characteristics.

Data about the achievement levels of individual students or about the distribution of ability levels for the students of feeder schools are available but have not been organized and analyzed by feeder schools. (This omission in district, or school, planning is strange. It would seem that the information gained from such an analysis would be invaluable in identifying and replicating the better practices of the more effective schools.) For Everett's feeder schools the range of the mean reading grade-equivalent scores was from a low of 3.8 to a high of 6.4.

As originally planned, the research was to investigate the outcomes resulting from changes in instructional strategy for the subject areas of mathematics and, possibly, reading at Mission Senior High School. Lack of data and the amount of time required by the high school staff caused cancellation of this area of investigation. Data on specific students who were in the classes of the mathematics teachers disappear at the end of each year and the data retrieval effort needed could not be supported by this research's resources.

The "story" of Mission High School's changes in resource use contributes to the underlying contention of the research--that school resources and *how* they are used can make a difference in outcome. For this reason, Mission High School's equal-cost route to increased school effectiveness is described in Section IV.

ORGANIZATION OF THE REPORT

The following Section II describes the development of Everett's learning centers and the differences in the instructional use of resources by each learning center. Section III presents the results of the analysis of the achievement test measures in support of the working hypotheses.

II. EVERETT JUNIOR HIGH SCHOOL'S INSTRUCTIONAL PROGRAM

INTRODUCTION

The Everett instructional changes were initiated about four years ago, partly because the faculty wanted to change the instructional process and partly because the District needed a school willing to pilot studies in PPBS program budgeting. The District solicited Everett to become involved in a process that replicated what the State had in mind in PPBS designs. The Everett faculty did a needs assessment involving the entire faculty in small group meetings and going back to large group meetings. The activity began with the definition of school goals. These were pretty well completed by the spring of 1972. About that time, one group of teachers at Everett said, "The 'goal-and-need' effort is fine, but what are we going to do for the incoming 7th graders who are going to be here in September? Are the students going to have the same old instruction or is the program really going to offer something different?". "If the 7th-grade program is redesigned, then what about the 8th-grade program?" "Can we define a foundation group of objectives that a 7th grader should be able to meet before he is designated an 8th grader?" And, "Can an instructional program be designed to accomplish these objectives?"

With these questions in mind, the Learning Center Program for 7th graders and the Cluster Classroom Program for 8th graders were developed. The 9th-grade program remained traditional in approach, primarily to provide the students with a transitional year before entering high school. The Learning Center Program assigns all 7th-grade students to one of six learning centers for all core academic subjects; the 8th-grade Cluster Classroom Program assigns students to one of five "clusters"--a cluster is a set of classrooms with a team of teachers that remains stable for the school year. Student assignment to a particular cluster also remains the same.

The process of implementing the 7th- and 8th-grade programs and the operational characteristics of each program are described in this section. The impact of these changes on student achievement in instruction is analyzed in Section III.

THE SEVENTH-GRADE LEARNING CENTERS

Several things were known about those students. First of all, they would be an ethnically heterogenous group. They would be reading somewhere around the 5.0-grade level, as a mean, and better than half of them would be in the lowest quartile of national norms. Within the group there would be racial tension. Everett had developed a bad reputation--noontime activities largely consisted of interethnic fights.

The group of teachers worked during the remainder of the spring semester and had a summer workshop in which they decided on a program that ultimately became the first learning center. Everett had the cooperation of the District and the incentive provided by the PPBS pilot studies. The District provided $6,000 for supplies and $22,000 for building modification. Walls were removed and a hallway, three classrooms, and a storeroom became one big room. Carpeting was laid, acoustical tile was put on the ceiling, and fluorescent lighting was added. The result was a learning center, 120 feet long and about 40 feet wide. It serviced about 120 incoming 7th graders in the morning with one team of teachers and 120 in the afternoon with another team.

The initial learning center operated for one year. The first year was hectic for a number of reasons. The facility was not finished until November, so about three months were spent floating among classrooms and teaching in the auditorium. The teachers had never worked as teams before but, in the process, they discovered how team-teaching works. Two major findings emerged during the first year. The performance objectives remained basically the same as originally stated and the learning center organization of instruction promoted socialization, easing racial tensions.

The initial battery of performance objectives was refined. (In the four years of operation, the objectives have been revised about

three times, but their essence remains fairly close to what was originally developed.) For example, the objective that students should have some ability to write a sentence still remains the basic element of the language program. The objectives that the students should be able to measure basic kinds of things, recognize inches in a foot and months in a year, use a ruler, and tell time still remain. Basic math and graph skills are still there. Being able to use the Resource Center, including card catalogs and audiovisual equipment, continues to be an objective of the program.

At the end of the year, it was discovered that the learning center, for all its logistic problems, was an enormous social success. This is the first time the students did not sit in traditional-size classrooms in straight rows of desk-type chairs. Rather, they were using tables and were shifting their groups for each activity and day by day. Thus, the composition of the groups changed continuously. Since the students did not have an assigned seat, they would simply sit next to different students and interact with other students constantly. This results in a completely different classroom environment.

Under the traditional arrangement of desks in rows, students really don't interact with other students because of their simple physical arrangement. In the learning centers, because the groups are constantly shifting, the students do interact with each other. This was not planned--it happened and was noticeable about eight weeks after the learning center opened. (A very easy intermixing of students in the learning centers has continued.) The boys and girls still tend to sit in separate groups because they are 7th graders, but the ethnic groupings vary and students are talking and interacting in a friendly manner with students of every ethnic group and crossing linguistic lines with real facility.

In the second year, two more learning center facilities were created so that the entire 7th grade was in the Learning Center Program. To do this, two groups of students who had never been incorporated in the mainstream of instruction before had to be included--students who don't speak English and the educationally handicapped (EH) youngsters.

In the fall of 1972, Everett knew from their files that 27 students were coming in the door who didn't speak much English, whose native language was Spanish. They also knew they had a similar number of students whose native language was one of about seven Filipino dialects. To cope with this problem, they organized Bilingual Learning Centers with one session in the morning and another session in the afternoon. The 27 students who were Spanish and whose English skills were limited or nonexistent were paired with 27 randomly selected English speakers, so there was a total of 54 students in each learning-center session. Half of the learning center was basically English-speaking, with no second language; the other half either spoke English as a second language or spoke no English at all. The intent of the program was to implement the basic 7th-grade curriculum in spite of the language problems. In addition, some instruction in both languages would be given so that all students would learn a little English, a little Spanish, and all would learn what they could about every cultural group represented in the room. In addition to this, some ESL support was provided.

In the other learning center, in the morning, the same thing was done with the Filipino students. They were paired with another selected group of English-speaking 7th graders. English-speaking Filipinos were eliminated so the learning center would not be unbalanced by any ethnic group. By this strategy, although the groupings were either heavily Filipino or heavily Latin, the learning centers were not more than 50 percent of the target ethnic/linguistic group.

For the EH youngsters, a third learning center was opened which was called the "Library" Learning Center simply because it was in the old library. This center handles about 53 youngsters simultaneously. Sixteen of those students are EH. The entire EH population is 32. Sixteen are in the learning centers at one time--one group in the morning and another in the afternoon. Both EH teachers are in the Library Learning Center. This staffing meets the State-required ratio of one EH teacher for eight students. The remainder of the students (37) are regular 7th graders.

It is difficult, when observing the Library Learning Center, to tell the difference between the EH students and the regular students, except for one or two who are physically conspicuous. The intention was to not single out the EH students. In many ways, EH students and those who have learning difficulties share similar problems. Nonreaders can be EH and nonreaders can be regular students. There are approaches that can be taken in teaching reading that are appropriate for both groups. Because of the shared problems of the students and because of the general orientation of the staff, the focus in the Library Learning Center is very heavily on reading. Two special reading programs are used. One is the Slingerland approach to reading and the other is the Monterey program. Both of these programs are very structured and diagnostic and are used in addition to conventional reading materials.

In total, the 7th grade consists of three learning centers, one quite large and two smaller centers, about half the size of the larger one. Both operate twice a day and serve about four hundred 7th graders. The 7th grader spends half a day in the learning center. During that time, all core academic subjects--English, Social Science, Math, and Science--are provided by an interdisciplinary teaching team on a flexible schedule. The rest of the day includes lunch, two electives (which are mini- and maxi-courses, nine- and twelve-weeks long) and a gym period. No distinction is made in the assignment of students in a.m. or p.m. learning centers with one exception. The Bilingual Learning Center has its Filipino component in the morning and its Spanish component in the afternoon.

THE EIGHTH-GRADE CLASSROOM CLUSTERS

In the 8th grade, the students are assigned to classroom clusters. Clusters, in the simplest form, are basically three teachers working in three rooms for three consecutive periods, with the same basic group of ninety or so students--approximately thirty students to a teacher. This structure gives the teachers all the options the learning center team have but with some limitations because of the size of the facility. But there are some pluses. For instance, teachers who are a little more traditionally oriented are willing to

work in a cluster classroom arrangement rather than a learning center because the clusters aren't "fishbowls." In a learning center, everybody can see what everybody else is doing; if your group is noisy, everybody else is aware of it.

(The learning centers are ideal vehicles for teacher training and the adjacent colleges have recognized this. Student teachers have the opportunity to see others teach, not only other student teachers, but the master teachers. They are able to work together as a team, plan together, evaluate together. The average student teacher rarely observes as many teachers on as large a scale. As a participant, the student teachers have a chance to talk about what they are going to do ahead of time and evaluate the results afterwards with their colleagues.)

Contrasted to the learning centers, the clusters are not fishbowls. The teacher can always shut the door and the team that isn't really functioning as a team, per se, can still function. Cluster classroom teachers can dislike one another, seldom speak to one another, never plan as a team, and still will not function any worse than they would in a traditional, self-contained, classroom-type of program. However, the potential for functioning together is very definitely there; teachers in all the Everett classroom clusters do. It is a team-planning situation. The flexibility is there; joint field trips can be taken, group size can be altered, the length of instruction can be adjusted in terms of the curriculum needs, and instructional emphasis can be varied within the classroom cluster.

The clusters, unlike the learning centers, are quite different from one another. Cluster V is called a seminar cluster; it is an ungraded cluster which makes it the exception. It operates in the afternoon, all afternoon, and serves 160 youngsters. Cluster V has "gifted" youngsters, "academically-talented" youngsters, and students who are recommended by their teachers. It is ethnically integrated. The average gifted program dealing only with the mentally gifted minors in this district has been plagued by a poor ethnic mix. By bringing in the academically-talented students and teacher-recommended students, Everett is able to develop an integrated group of students.

As a result, there is quite a range of ability within Cluster V. The students in this cluster have more to say about the curriculum than do the students in any other organizational group. The curriculum changes from unit to unit and from year to year depending on the desires of the teachers and the students. Their basic objectives are relatively fixed, but the actual program implemented to reach those objectives varies. This year, for instance, the whole group (160) went up to Yosemite for a week in the beginning of the year. This was an introductory experience, designed to promote togetherness. Algebra is not taught in Cluster V, but is offered as an option outside the cluster. Biology is also taken outside the cluster, but the student may also get some math and science experiences in the cluster. Overall, Cluster V is an academically oriented program. The students who are in it usually choose academic electives also.

Cluster IV is the cluster where the career education concept is used as the unifying curriculum structure. The students in Cluster IV spend a good deal of time out in the field observing industry, and working through the National Alliance of Businessmen, to get outside experiences at a variety of industries. The idea is that these outside resources, and the community's interaction with the school, are going to make a significant difference with these younsters. The career education program also has roots and tentacles in the 9th-grade program, in the 7th-grade learning centers, and in some of the other clusters, too. But Cluster IV is where the activity is the heaviest.

Cluster III is called the Trilingual Cluster. Cluster III in the 8th grade grew out of the Bilingual Learning Centers in the 7th grade. Cluster III serves about 85 students with 3 teachers and 3 classrooms. The initial concept was that one group would be English-speaking, one group would have Filipino as their native language, and another group would have Spanish as their native language. Now they are intermingled in this cluster. The program of Cluster III attempts to conduct the basic 8th-grade instructional program, supplying ESL support and providing information about each linguistic and cultural group represented.

Cluster II has a mammoth input of student-teacher resources. Dr. Ray Roberts of San Francisco State College brings his entire seminar

of student teachers and observers (who are in the semester before student teaching) into Cluster II. The cluster has 4 teachers and about 120 students. In 1974-75, at the beginning of the winter, there were about 27 observers and 9 student teachers in addition to the 4 teachers. The number of adult staff per student is very high. In any case, that cluster because of the heavy input of adult personnel is very different from the other clusters of the program. (When asked if the student teachers and observers could be spread out among the other clusters, the answer was "yes," but Dr. Roberts has elected not to. His reasoning is that he wants a basic unit wherein all of his people are involved, so that they can share experiences with the same basic group of youngsters, plan, evaluate, and compare notes. He is interested in building a model for teacher training.) Cluster II probably has the most innovative of all the curriculums because of the amount of new thinking that goes in there. Those who have just finished theory courses, and those who are getting theory courses at the same time that they are involved with the students, are going to be experimenting. Consequently, there is a good deal of variety in Cluster II's curriculum.

Cluster I is possibly the most traditional of the clusters. It has 3 teachers, 3 classrooms, and 3 classes of students, and is probably closer to the basic model of the clusters as originally conceived. One teacher is an English teacher, one is a Science teacher, and one is a Math teacher. They cooperate on the Social Science component of the program. There is one aide who assists all 3 teachers. They do not have student teachers this year. It is essentially operated in line with what a cluster is supposed to be. As described, the other clusters have major differences (gifted students, career education, three language groups, many student teachers) from the more pure Cluster I.

Everett's 7th-grade and 8th-grade programs have contributed to the students' educational maturing. The 7th-grade program is similar to the elementary school classrooms, with the student spending the whole day with one teacher in one classroom. In grade 7, the student is in a larger group than before, but is still in one big room most of the day, interacting with the same team of teachers. Instruction is still in one place rather than having English in one room, Social Science in another,

and Math in still another. In grade 8 the student, in three separate, but joined, rooms, is taught by a team of teachers.

The 8th-grade program serves as a transition into the 9th-grade program which is the segmented type of curriculum of the traditional junior high school. Everett's 9th-grade program is traditional; it prepares the students to deal with the high-school level activities. The instructional organization of the 7th- and 8th-grade program eases student transition from elementary practices to junior-high school practices, while the 9th-grade program directly feeds into high-school life.

THE MEDIA CENTER

Individualizing instruction at learning centers means that contracts were used as a vehicle to get students to progress in terms of the basic curriculum. The curriculum required a rather large variety of media. The Title II grant was written to describe the Media Center as the hub of the individualized curriculum. The Media Center, now serving all grades, probably has the best research capability of any school library in San Francisco. A student can go into the Media Center on his free time after school or during noon hour and pursue almost any interest he wishes by selecting film strips and using the equipment. There are several options the student can exercise to get assistance in either finding material, operating equipment or asking a question about what he is viewing. He can ask teachers, other students, student workers who are trained to help, or paraprofessional aides to help him.

The Media Center is used in another way, too. Not only can a student go there in his free time, but he can be sent there on a contract from any classroom. The contracts vary from the very simple to the rather complex. The essence of the contract is spelled out--its objective and evaluation criteria; the student and the teacher work out the steps for learning. In cases where the contracts are too broad, the student is sent back to the classroom teacher for clarification. When the system is working as it is supposed to, the student will go to the Media Center with a reasonably well-defined objective, and the

Media Center staff will work with him to implement that objective in ways that are appropriate to his needs and his interests. For example, if he has an assignment on researching a sports activity, he can go to any of about six or eight different media and work his way through completely visual material, material with an audio component, and printed material. The Media Center has research capabilities in microfilm and microfiche, art prints, tapes, film strips combinations, film loops, and the usual variety of printed material, providing a rather sizable amount of resources in support of instruction.

THE ESL BILINGUAL PROGRAM

The Bilingual Learning Centers and the Trilingual Cluster have been described. Those programs apparently incorporate a sound design because the students do interact across linguistic and racial lines. Ethnic groups are no longer operating as isolated units. Under past practice, students whose native language was Spanish were assigned to a Spanish-speaking teacher. They would spend most of their day together. The ESL students would be taught in a group, giving them bilingual instruction in Spanish. That meant the student was with Spanish-speaking peers and Spanish-speaking teachers for a minimum of three periods a day. It was usually more than that because he would have lunch and gym with his friends. Actually, there was very little, if any, time during the day when the student had to speak English. He could get along fine. The teachers spoke Spanish, his friends spoke Spanish, he had no reason to speak English at all. Neither did he have much opportunity to hear English spoken.

This organization frequently produced both an isolated student who very seldom learned English and an isolated group who did not interact with the rest of the school. There were really no bridges built between groups. Add the Filipinos, Everett's fastest growing minority population--rising from about 16 percent five years ago to about 26 percent this year--and a major bilingual problem exists.

In order to maintain the multicultural contacts and the intensive instruction occurring in the learning centers, Everett applied for funds

to set up a bilingual program under AB 2284. The funds received were about half the request and were quite late in arriving, but Everett finally implemented the present ESL bilingual program. As discussed, at grade 7 the bilingual youngsters were assigned half and half with English speakers. Only those Spanish speakers who had no English at all stayed in a single group in the afternoon session of the learning center where they could get the needed additional support. The same strategy was used with the Filipinos who were assigned to the morning Bilingual Learning Center. The Chinese non-English speakers and other non-English speakers are in all 7th-grade learning centers this year.

For the 8th grade students, Everett kept their non-English speakers in Cluster III so they could be served with existing funds until the additional funds were received. There was no way those youngsters could be dispersed. With AB 2284 funds, Everett implemented a program to serve 200 youngsters with eight sections of ESL scheduled throughout the school day. Different levels of ESL are taught during different periods. Six native language sections are taught in Filipino and three in Spanish. Other courses include: Latin American History taught in Spanish, Spanish-Language Composition, Spanish-Language Math Science, and Philippine Culture taught in the language. Mandarin is taught as an elective. In essence, the language is taught and subjects are taught.

These subjects and the ESL bilingual program overlay the learning center and cluster programs with the student still involved in the learning center or cluster, per se. In other words, if the student is in the bilingual program in the 7th grade, he can be scheduled into the ESL program at the appropriate level in the 8th grade and still be an active participant in the cluster program and be in an English-speaking group four periods a day. There are two more periods a day when he may be taking ESL language instruction in his native language. So through counseling, the student may be assigned into as intensive a program as needed--even a program where he has no other electives at all other than language-based electives. (In some cases a student in the 7th-grade learning center may also be drawn out of the classroom clusters for one period of ESL.) But the fact remains that the overwhelming majority of

students are now heterogenously grouped in an English-language-based curriculum with reinforcement in ESL at the right level.

Everett's instructional model requires more staff than the minimum of one teacher for 30 students. When the learning center started, they relied heavily on the colleges for student teachers in order to increase individualization of instruction. But student teachers change; different fields and various competencies would be available every six months. To get away from that situation, Everett employed paraprofessionals, using Senate Bill 90 funds. (Senate Bill 90 extended up to grade 7 because Everett is an impacted, with educationally disadvantaged students, school.) The staff wrote a proposal that had as its major element the bringing in of paraprofessional assistants. The majority of monies coming to Everett under SB 90 are used for hiring paraprofessionals who work mostly in the learning centers, although some are in the clusters. These paraprofessionals are assigned to one team and work four hours--an hour preceding the session, and three hours duirng the time the team is in session.

Everett has a total of 27 instructional aides for a total of 132 hours per day. Sixteen aides (64 hours) are funded from SB 90 funds, five aides (26 hours) from AB 2284, two (12 hours) from ESAA funds, and four aides (30 hours) from district funds. Five aides work in Cluster III for 12 hours and five aides are in the ESL program for 18 hours. Clusters I, IV, and V have three aides for a total of 10 hours. The remaining aides and 92 hours are distributed among the Learning Centers with 20 hours each for Learning Centers 1 and 2, 14 hours each for Learning Centers 5 and 6 and 12 hours each for Learning Centers 3 and 4.

SCHOOL-WIDE INSTRUCTIONAL PROGRAMS

An allocation of Everett's teachers by classroom and subject areas was developed in the process of identifying the research units of analysis. The allocation was by the different instructional organizations for each grade--the 7th-grade learning centers, the 8th-grade classroom clusters, and the 9th-grade subject departments. Everett has also characterized its entire instructional program by five school-wide

programs with instructional goals for the students. These are:

- o Reading and Communication
- o Learning How to Learn
- o Individual Development: Skills, Knowledge and Understanding
- o Individual Development: Physical and Manual Dexterity
- o Individual Development: Attitudes, Appreciations and Values

The principal and the administrative staff were interested in gaining insights about the instructional emphasis the teachers were giving to meeting each of these goals.

To accomplish this objective, each teacher was asked to estimate, for each subject, "the amount (in percent) of your energies you expend in each of your classes in each of the five programs." (The request was worded so as to avoid asking for a specific *time* allocation by minutes per week.) Ninety-five percent of the teachers returned the questionnaire, apparently after giving serious thought to differences in the subjects they taught. From the individual teacher estimates, an allocation of energy devoted to each of the five programs and an estimate of *cost* (teacher salary x the "energy" estimate, using a seven-period day was estimated). The teacher time devoted to school-wide planning, to subject planning, to school administration, and to operations was also estimated. Operations included such activities as the Media Center operation, the Library and yard duty. The results are shown in Table 1.

Everett plans to use achievement test results and other measures such as problem-solving ability, student facility in the use of resource materials, psychomotor skills, and behavior indicators as measures of success in the five programs. This information, used to identify problems or unsatisfactory progress within a program, along with the baseline allocation of teacher energy will be used in assessing the need for changes, particularly a reallocation of teacher efforts.

From the standpoint of decisions that might be made, it seems unfortunate that the third program--Individual Development: Skills, Knowledge and Understanding--includes all the arithmetic/mathematics subjects. It would seem that student skill in this area is almost as important as student skill in the first program--Reading and

Table 1

ALLOCATION OF TEACHER COST AND TIME,
EVERETT JUNIOR HIGH SCHOOL

Program Activity	Percent Time	Cost
Instruction	69%	$738,661
A. Reading and Communication	30[a]	181,296
B. Learning How to Learn	15	117,282
C. Individual Development: Skills, Knowledge and Understanding	24	184,731
D. Individual Development: Physical and Manual Dexterity	12	112,997
E. Individual Development: Attitudes, Appreciations and Values	19	142,355
Other Activities	31%	$417,607
Subject Planning	16	213,703
School-wide Planning	6	77,232
Administration	1	5,649
Operations	8	121,023
Total	100%	$1,156,268

[a]The figures for each Program represent the percent of instructional time; i.e., the 30 percent for Program A is 30 percent of the 69 percent of instructional time.

Communication and that the school would want to know the teacher resources devoted to teaching these skills.

SEVENTH-GRADE LEARNING CENTER VARIABLES

For the 7th-grade Learning Center the energy devoted to each of the five broad instructional programs is shown in Table 2. Because

Table 2

PROGRAM EMPHASIS BY LEARNING CENTER

Program--Instruction	Percent of Time by Learning Center				
	1	2	3	4	5&6
A. Reading & Communication	40	40	30	30	50
B. Learning How to Learn	10	18	22	10	10
C. Individual Development: Skills, Knowledge and Understanding	35	18	25	30	25
D. Individual Development: Physical and Manual Dexterity	5	9	8	5	5
E. Individual Development: Attitudes, Appreciations and Values	10	15	15	25	10
Total	100	100	100	100	100

the data are teacher estimates of the energy (converted to time), they denote to the different programs and because the information was obtained for a different purpose, it is felt that these profiles are not a realistic picture of the instructional emphasis within an individual learning center. The figures do reflect, however, an average of the estimates for each teacher in the learning center.

The six learning centers do differ for other variables that delineate alternative uses of resources. These variables for each learning center are shown in Table 3. The measurement of some of the variables is extremely subjective with the director of the Learning Center Program providing the values in cases where the center is

ranked on a scale of 1 to 4. These rankings and the data of record were all obtained before the achievement test measures were analyzed by learning center.

Table 3

LEARNING CENTER VARIABLES

Variables	Learning Centers				
	1	2	3	4	5&6
Students/Teacher	25	25	19	19	30
Aide-hours/Day	20	20	12	12	14
Teacher/Aide Interaction[b]	2	3	1	1	3
Percent ESL Students	15	15	50	50	10
Media Center Use[c]	4	4	1	2	3
Individualized Instruction[d]	2	3	1	1	4
Teacher Cooperative Interaction[d]	3	4	1	1	2
Basic Skills Emphasis[d]	1	2	2	1	3

[a]Learning Centers 5 and 6 are identical in terms of staffing and variables.

[b]On a scale of 1 to 4, the estimate of the level of teacher and teacher-aide interaction in planning, instruction, and evaluation.

[c]An estimate of the use of the Media Center, based on an average use as low (1), medium (2), with higher or well above average use as (3), and (4) meaning the most use.

[d]On a scale of 1 to 4, the numbers represent the relative rankings of each learning center.

III. ANALYSIS OF ACHIEVEMENT TEST MEASURES

INTRODUCTION

The general approach in this section is to report the major findings of the exploratory analyses with the more detailed and technical aspects of the multivariate analysis being reported in Appendix C. The major analytic tool used is the multivariate linear model and more specifically the multivariate analysis of variance (Finn, 1974). Multivariate analysis of variance is merely an extension of univariate analysis except that more than one dependent variable is considered at one time. The four dependent variables were student's grade-equivalent scores on the reading, language, mathematics, and study skills subtests of the Comprehensive Test of Basic Skills (CTBS). Both pre- and post-tests were available for 7th-grade students attending Everett Junior High School. Pre-testing was done in September and post-testing in May.

The investigation of the two working hypotheses is discussed: The impact of the feeder schools and the learning centers on the performance of Everett's 7th-grade student is analyzed first. The impact of a 9th-grade student's being in Everett's 7th-grade and 8th-grade programs is then assessed. The same data (for reading only) are used in an idiographic analysis of achievement test scores to provide additional insights.

IMPACT OF FEEDER SCHOOLS AND LEARNING CENTERS

The hypothesis that is addressed here is whether some feeder elementary schools, using approximately the same quality and quantity of resources, and having students with relatively the same socioeconomic status (SES), ethnic distribution, mobility factor, and mix of academic capability will "produce" students who do better in the 7th-grade core academic subjects (reading and mathematics) than students from other feeder elementary schools. In an experiment, one would want to have a pool of students that could be randomly assigned to various feeder schools. Then, after a number of years of attendance at the feeder schools, the students could be compared as to their academic achievement.

However, the realities of contemporary education do not very often afford the luxury of the use of classical experimental designs. The only recourse is the use of data from preexisting groups to do exploratory data analysis. It is in this spirit that the investigations to be reported should be viewed.

The feeder schools from which the grade students came were identified and formed the first factor in the analysis of variance. The second factor consisted of what learning center students were placed at Everett Junior High School. Thus, there is a two-way analysis of variance--i.e., feeder school by learning center. The analysis of variance is also used to see if there is an interaction between feeder school and learning center. The first analysis asks, "Are students significantly different on the pre-tests (the four dependent variables were analyzed simultaneously in a multivariate analysis of variance) between feeder schools and learning centers?" Significant differences were expected between feeder schools either due to differences in population between feeder schools or because of the differential impact of the schools. (It is known that the educationally handicapped students were split between Learning Centers 3 and 4 and that one of these two centers had students whose native language was Filipino and the other had the non-English speaking Latino students. It was suspected that students may have been nonrandomly assigned to Learning Centers 1, 2, and 5/6 at the beginning of the year.) However, since the pre-test was administered at the beginning of the year, no interaction was expected between feeder school and learning center since the different instructional impact of the various learning centers could not be expected to have any effect at this time. The results confirmed these hypotheses fully. Students in various feeder schools and in various learning centers were significantly different from each other on reading, language, mathematics, and study skills, considered jointly, but the interaction between feeder school and learning center was not significant.

Given that the various feeder schools are significantly different from each other overall, it is of interest to see which ones are, in fact, significantly different. One approach would be to use multivariate

a posteriori comparisons of group means. However, these have not been well worked out for the multivariate case. Thus, one is forced to use univariate comparisons where the probability of Type I error is not controlled or to use other measures which have the same conceptual problems. In this investigation it was opted to look at the larger least-squares estimates (regression coefficients). For reading, the estimates for the Filipino Educational Center, Gratton, and Webster Schools were quite large relative to the others. The Filipino Educational Center and Webster were 1.18 and .95 grade equivalents below the overall mean for feeder schools on the reading pre-test while Gratton was 1.28 grade equivalents above the mean. On the language sub-test, Gratton and Henry schools were both 1.25 grade equivalents above the mean while Webster was 1.29 grade equivalents below the mean. Gratton was .64 grade equivalents above the mean on the mathematics sub-test. Finally, on study skills Gratton was also above the mean by 1.69 grade equivalents. Observed pre-test means are reported in Table 4 for each feeder school.

Table 4

FEEDER-SCHOOL OBSERVED PRE-TEST MEANS SUMMED OVER LEARNING CENTER

Feeder Schools	N	Reading	Language	Mathematics	Study Skills
Filipino Educational Center	10	3.63	4.18	4.83	3.77
Unknown	14	5.21	5.00	4.93	4.58
Carmichael	37	4.95	5.26	5.53	4.85
Henry	10	5.74	6.59	5.94	5.39
Clarendon	16	5.51	5.86	5.64	5.50
Gratton	22	6.66	6.71	6.17	7.02
King	30	5.46	5.17	5.72	5.23
Webster	10	4.26	3.94	4.74	4.21
Laguna Hondo	17	6.09	5.91	5.34	5.51
Rooftop	6	5.75	5.00	5.75	5.27
Other	19	5.56	4.88	5.31	5.04
Redding	27	5.22	5.16	5.60	5.43
Jefferson	19	4.94	4.89	5.02	4.55
Edison	8	4.40	4.96	4.81	4.68

The second step consists of looking at differences between learning centers. Table 5 shows observed pre-test means for each learning center. For purposes of the analysis, Learning Centers 5 and 6 were combined since they offered essentially the same program, one in the morning, the other in the afternoon. Least-squares estimates (reported

Table 5

LEARNING-CENTER OBSERVED PRE-TEST MEANS SUMMED OVER FEEDER SCHOOLS

Learning Center	N	Reading	Language	Mathematics	Study Skills
1	65	5.64	5.73	5.72	5.31
2	79	5.84	5.92	5.88	5.98
3	29	4.29	4.21	4.55	3.86
4	21	4.80	4.92	5.46	4.78
5 & 6	51	4.93	4.65	5.00	4.67

in Table C.2, Appendix C) show that at the beginning of the year, Learning Centers 1 and 2 were .72 and .73 grade equivalent scores higher than Learning Center 5/6 (combined) on reading. Similarly, these two learning centers were 1.06 and 1.13 grade equivalents, respectively, higher than Learning Center 5/6 on language, .69 and .76 higher on mathematics, and Learning Center 2, 1.06 grade equivalents on study skills. These data then indicate that if we realistically want to assess the growth of students during the year that may be attributable to learning centers, then we must control for the initial disparity in academic achievement at the outset of the school as evidenced by the large differences between various learning centers on the pre-test.

The second phase of the analysis focuses on post-test scores. First, a two-way analysis of variance using learning centers and feeder schools as independent variables was performed. The analysis showed that learning centers and feeder schools were both significant but that there was no interaction between the two. These findings are not easily

interpretable, however, since both feeder schools and learning centers were significant on the pre-test. Consequently, it was decided to use analysis of covariance. Analysis of covariance is similar to analysis of variance except that the dependent variables are adjusted using a concomitant continuous variable. In this case, the scores on the four pre-tests were used as the concomitant variable. In essence, the analysis of covariance partials out the effects of the pre-test on the post-test using linear regression before the analysis of variance is performed.

There are many difficulties in using the analysis of covariance with the intent of adjusting post-test scores on the basis of pre-test scores when students are not randomly assigned to groups. Cronbach and Furby (1970) and Campbell and Erlebacher (1970) argue strongly and persuasively that such adjustments should not be performed. The major difficulty stems from the fact that the predictor variable or covariate is, in this case, a fallible measure. A student's observed score thus consists of a true component of the student's ability plus a random error component. The fallible measure of pre-treatment achievement serves to attenuate the regression coefficient of the regression equation predicting post-test performance.

Analysis of covariance was nevertheless used in the following analysis for the following reasons: (1) the objective of the analysis is primarily exploratory rather than confirmatory; (2) given that the analysis is primarily exploratory, it is better to take into account all the information giving a slightly biased result than one which has greater bias; (3) although there is certitude that student assignment to Learning Centers 3 and 4 was nonrandom (students in these two centers were assigned on the basis of their native language and the school's educationally-handicapped students were split between these two learning centers). There is reason to suspect that assignment to the other learning centers may have been on a random basis. However, since the investigators did not participate in the assignment procedure and information about the assignment is based on the school administrator's recollections, the data are interpreted as if random assignments of students to groups had not occurred.

The regression analysis showed that the pre-test scores were significantly related to the post-tests. Each covariate (pre-tests on reading, language, mathematics, and study skills) accounted for a significant proportion of the variance on the post-tests. Once post-test scores were adjusted for pre-test scores, it was found that only learning centers were significantly different from each other, while feeder schools and the interaction between feeder school and learning center were not significant. These data then indicate that the learning centers had a differential impact on students over the academic year. Looking at the least-squares estimates after the adjustment for the covariates, it can be seen how the various learning centers stand relative to the comparison group which in this case was Learning Center 5/6 (combined). Least-squares estimates are reported in Table 6. For reading, Learning Centers 1, 2, 3, and 4 are 1.23, 1.25, .77, and 1.15

Table 6

LEAST-SQUARES ESTIMATES ADJUSTED FOR COVARIATES

Learning Center	Estimates on Post-Test Scores			
	Reading	Language	Mathematics	Study Skills
1	-1.23	-0.58	-0.17	-0.93
2	-1.25	-0.54	-0.48	-1.18
3	-0.77	0.02	0.38	-0.08
4	-1.15	-0.94	-0.60	-1.59

grade equivalents below Learning Centers 5 and 6 combined. On language, Learning Centers 1, 2, and 4 are .58, .54, and .94 grade equivalents below Learning Centers 5 and 6. For mathematics, Learning Centers 2 and 4 are .48 and .60 grade equivalents below, respectively, Learning Centers 5 and 6 combined, while Learning Center 3 is .38 grade equivalents above Learning Centers 5/6. Finally, on study skills, Learning Centers 1, 2, and 4 are .93, 1.18, and 1.59 grade equivalents below

Learning Center 5/6. A caution should be made at this point vis-á-vis the interpretation of these findings. The results would seem to indicate overall superiority of Learning Center 5/6 over the other learning centers in all subject matter areas. However, it must be noted that the reading, language, mathematics, and study skills tests are highly correlated with each other. This means that it is possible that the tests are redundantly measuring the educational gains.

EVERETT'S IMPACT ON NINTH-GRADE ACHIEVEMENT

The working hypothesis was that changes in the 7th and 8th grade instructional organization at Everett Junior High School had discernible, positive effects on the academic performance of those students in the 9th grade. The hypothesis was operationally defined as "the longer a student has been attending Everett Junior High School, the better his academic performance should be." Thus students were categorized into three groups: students who had attended Everett for 15 months or less; students who had attended Everett betweeen 16 and 26 months; and students who had attended Everett 27 months. One-way analyses of variance were performed using the amount of instruction at Everett as the independent variable and post-test scores on reading, language, math, and study skills as dependent variables. It would have been preferable to carry out a multivariate analysis which would have considered all post-test measures jointly. However, many students missed one or more of the post-tests, making such an analysis impossible. Thus, four separate analyses, one on each post-test, were carried out. We were mainly interested in the possible impact of attending Everett on study skills and reading, since these were emphasized. The results of the four analyses, on study skills, reading, language, and mathematics are reported in Tables 7 through 10, respectively. The post-test was level 3, Form Q of the Comprehensive Test of Basic Skills administered in the spring of 1975.

The results disconfirm the hypothesis completely. First of all, students who had attended Everett 15 months or less, 16 to 26 months, and 27 months did not differ significantly from each other on study

Table 7

ANALYSIS OF VARIANCE ON THE STUDY SKILLS POST-TEST USING NUMBER OF MONTHS ATTENDANCE AT EVERETT AS THE INDEPENDENT VARIABLE

	Mean Square	DF	F
Among Groups	9.48	2	1.85[a]
Within Groups	5.11	127	

[a] $p > .10$

Means and Standard Deviations by Groups

Months at Everett	N	X	S. D.
15 or Less	50	6.39	2.60
16 to 26	30	5.41	1.53
27	50	6.21	2.19

Table 8

ANALYSIS OF VARIANCE ON READING POST-TEST USING NUMBER OF MONTHS ATTENDANCE AT EVERETT AS THE INDEPENDENT VARIABLE

	Mean Square	DF	F
Among Groups	4.83	2	.85[a]
Within Groups	5.68	139	

[a] $p > .40$

Means and Standard Deviations by Groups

Months at Everett	N	X	S. D.
15 or Less	54	7.31	2.41
16 to 26	23	6.57	2.14
27	65	7.24	2.38

Table 9

ANALYSIS OF VARIANCE ON LANGUAGE POST-TEST USING NUMBER OF MONTHS ATTENDANCE AT EVERETT AS THE INDEPENDENT VARIABLE

	Mean Square	DF	F
Among Groups	6.54	2	1.24[a]
Within Groups	5.26	119	

[a] $p > .30$

Means and Standard Deviations by Groups

Months at Everett	N	X	S. D.
15 or Less	45	7.74	5.72
16 to 26	16	7.01	4.88
27	61	7.07	4.76

Table 10

ANALYSIS OF VARIANCE ON MATHEMATICS POST-TEST USING NUMBER OF MONTHS ATTENDANCE AT EVERETT AS THE INDEPENDENT VARIABLE

	Mean Square	DF	F
Among Groups	15.31	2	3.36[a]
Within Groups	4.56	116	

[a] $p < .05$

Means and Standard Deviations by Groups

Months at Everett	N	X	S. D.
15 or Less	40	7.79	2.35
16 to 26	22	6.33	1.70
27	57	7.18	2.07

skills, reading and language, as evidenced by the analyses of variance. On mathematics, however, the groups were significantly different from each other at the .05 level. But, the highest scoring group was the one which had spent the least time (15 months or less) at Everett. Group means on the mathematics post-test are also reported in Table 10. In sum, then, reading performance of the 9th-grade student who had been at Everett for only the 9th grade did not differ significantly from the student who had attended the 8th-grade and the 7th-grade programs. In mathematics, the students who had been at Everett for one year or less fared better than those who had been there for the earlier grades. Thus, the hypothesis that the 7th-grade and 8th-grade programs at Everett had discernible, positive effects on academic performance of those students in the 9th grade is not corroborated.

IDIOGRAPHIC ANALYSIS OF TEST SCORES

Achievement tests, despite their imperfections, are still useful in assessing academic progress. Idiographic analysis is one way of using the test measures. The pre-test score is used to calculate the expected score--a rough predictor of future performance. The post-test score is the observed performance. Two rather drastic assumptions, however, need to be made. One assumes that the student progresses at an average rate; the second assumes that progress over and above the expected progress during the time period is attributable to the "treatment" involved. The idiographic analysis of achievement measures uses the student's past performance as the control mechanism. In brief, because a student's achievement at the beginning of the year is assumed to reflect the average rate of progress during the previous years, the student is his own control.

The very real limitations inherent in the technique are acknowledged. But the results, when viewed with the limitations in mind, do provide additional insights not apparent through conventional analysis of student achievment data. The learning center and feeder school idiographs for reading achievement (using the mean score for the group of students) are discussed here. The individual student idiographs for reading, showing each student's performance, by feeder school, are

included in Appendix D. The differences in the performance of students, grouped by learning center, are explored for Learning Centers 1, 2, and 5/6 (combined).

Incoming 7th-Grade Students by Feeder School

As mentioned earlier, Everett's incoming 7th-grade students are usually reading below the 5.0-grade level, as a mean, with more than half the students in the lowest quartile of national norms. It is interesting to note the distribution of the reading scores by feeder school shown in Table 11. (In the idiographic analysis, students who could not be identified by their feeder school and were grouped as "Unknowns" for the multivariate analysis are excluded. Feeder schools who contributed less than six students and were grouped as "Other" in the multivariate analysis are also excluded in this discussion.)

Table 11

READING ACHIEVEMENT OF EVERETT'S 7th GRADE STUDENTS USING FEEDER SCHOOL GROUPS

Feeder School	Grade-Equivalent Scores			
	Mean Pre-Test	Mean Post-Test	Expected	Difference
Rooftop	5.7	6.3	6.2	+.1
Laguna Honda	5.7	6.1	6.2	-.1
Webster	3.7	4.6	4.0	+.6
Redding	5.0	6.0	5.4	+.6
Jefferson	5.3	6.2	5.8	+.4
King	5.3	6.1	5.8	+.3
Gratton	6.4	6.9	6.9	--
Clarendon	5.5	6.4	6.0	+.4
Henry	5.6	6.5	6.1	+.4
Carmichael	4.7	5.5	5.0	+.5
Edison	4.7	5.7	5.0	+.7
Filipino Education Center	3.8	4.8	4.1	+.7

The mean pre-test reading level (in grade-equivalent scores) of the incoming students from the feeder schools ranged from a low of 3.7 (Webster) to a high of 6.4 (Gratton). The expected score is divided by seven (the years in school) to determine the average yearly progress. For the year of the data, the expected progress, or gain, is multiplied by .7 to reflect the actual instructional time for Everett's students for the year. An extended city worker and teacher strike and the timing of the tests resulted in assuming the shorter instructional time. The mean post-test grade-equivalent ranged from a low of 4.6 (Webster) to a high of 6.9 (Gratton)--a finding that would be anticipated.

As can be seen from the data of Table 11, most feeder school performances were better than expected. Gratton did as well as expected; Laguna Honda fell slightly below. When these data are displayed using the idiograph by feeder school other facets are revealed.

The three feeder schools ranking highest on the pre-test all performed about as expected. The other feeder schools consistently did better than expected, with those schools ranked lowest having the most startling gains. Two factors may explain these results; (1) it is "easier" to achieve better than expected performance from those students who are 2 or 3 years below grade-level, or (2) the Everett instructional strategies (including the curriculum and the use of resources) are, in fact, more successful for the previously lower-achieving students.

It is reasonable to assume that both factors are operating. But, even if this were the case, Everett's 7th-grade teachers have information that should be useful in redesigning the 7th-grade instructional program. Conjecturally, it might be asked if the instructional program as currently designed lacks sufficient challenge for the higher-achieving students. The point here is that the mean pre-test and post-test scores for the 7th-grade students, as a group, do not provide the information gained through the idiograph.

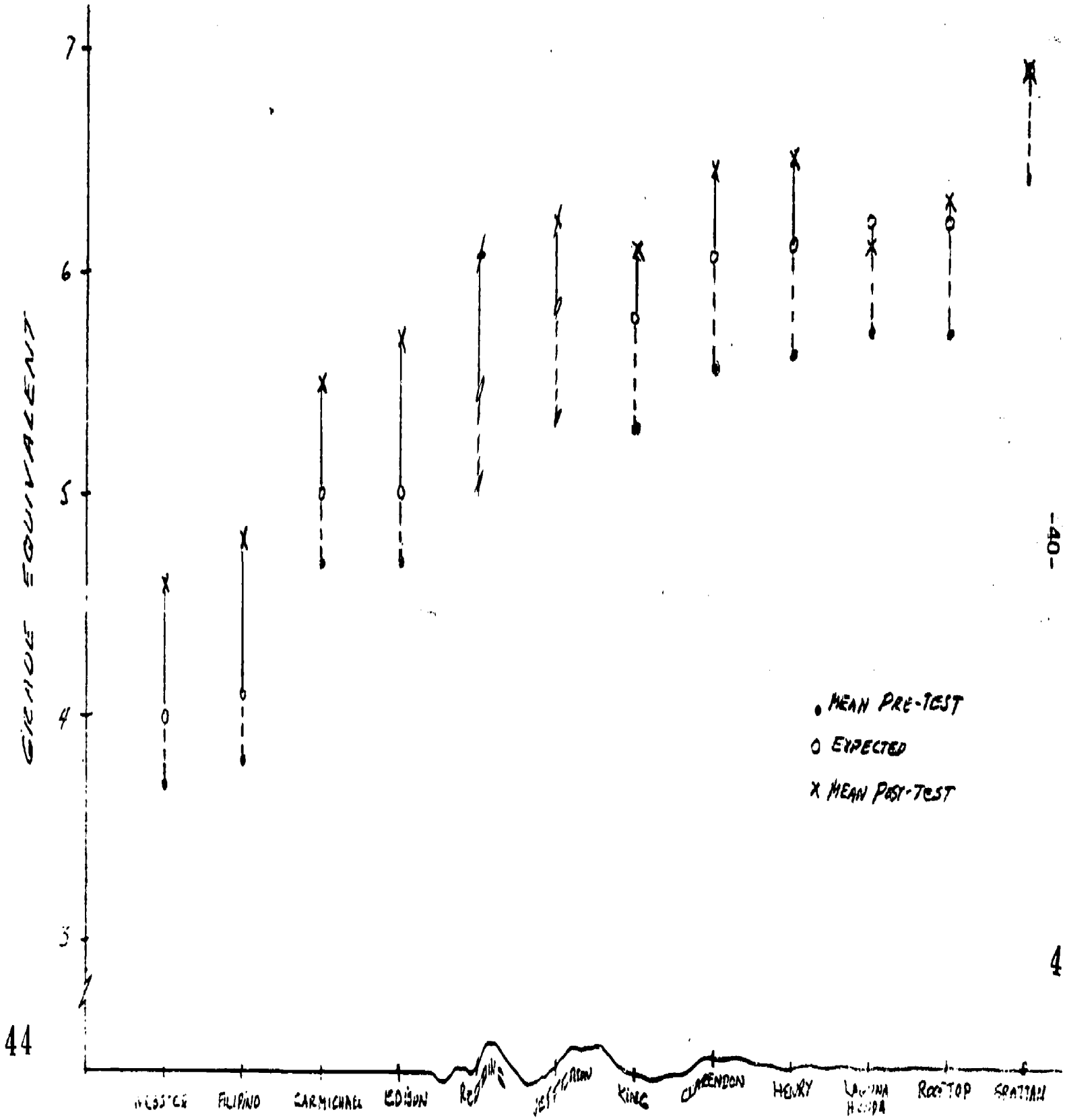

FIG 1. READING SCORES - 7TH GRADE

The use of quartile shifts--the shift in the percentage of students who are in each quartile--does provide slightly more information about the performance of the 7th-grade students but obscures the magnitude of the shift for individual students.

Table 12

QUARTILE RANKING--7th-GRADE READING

Item	Quartile				
	I	II	III	IV	Total
Percent of Students Pre-test	49	28	19	4	100%
Percent of Students Post-test	36	26	25	13	100%

Equally unrewarding are the statistics for the 7th grade as a whole: The incoming 7th-grade students had a mean reading pre-test grade-equivalent score of 4.9 and a mean pre-test score of 5.5. Using the "expected" aspect of the idiographic analysis, the students performed slightly better than expected. The information, as signals for change, developed through the idiographs is not available through the conventional analysis of achievement test measures. Examination of the idiographs, grouped by learning center, provides additional insights about Everett's 7th-grade program.

Learning Center Performance

As discussed in Section II, all Everett's 7th-grade students were assigned to one of six learning centers. The learning centers are identified by number in this analysis. The nature and instructional variables for each learning center were also discussed in the previous section. Learning Centers 3 and 4, the centers with non-English speakers and the educationally handicapped are not included here. (The idiographs for these centers are in Appendix D.) The students from Learning Centers 5 and 6 are grouped as Learning Center 5/6.

The reason is symptomatic of the data problems encountered; it was not possible to search the past records to identify which students were in each center. (Records were maintained by teacher not by center.) Analytically, it makes no difference. Unlike Learning Centers 1 and 2, Learning Centers 5 and 6 had the same team of teachers and the same instructional variables. The only distinction was that Learning Center 5 was in the morning and 6 was in the afternoon.

The idiographs for Learning Centers 1, 2 and 5/6 are shown here. On the pre-test scores, Learning Center 1 and Learning Center 2 had approximately the same range for their students; Learning Center 5/6 students, on a one-to-one basis, were almost two grade levels below the students of Learning Center 1 and Learning Center 2. More students in mid-range in Learning Centers 1 and 2 did better than the students at the higher and lower ends of the range. While in Learning Center 5/6 almost all students, regardless of pre-test status performed much better than expected. The presence or absence, in effect, the number of light vertical lines connecting the post-test score and the expected score provides a direct visual impression of the performances of the different learning centers. At the upper end of the post-test there is an evident "topping-out" on the test used, especially for the students of Learning Center 5/6 and Learning Center 2. The use of a straight-edge can provide additional information about the performance of the learning centers. For example, placing the straight-edge at grade-level will allow a count of the number of students who pre-tested at or below grade-level or the number of students who are now at grade-level on the post-test.

As an aside, the use of idiographs is not proposed as anything more than an alternative, quick, and simple way to display achievement measures. It is suggested that the teachers of the learning centers might prepare idiographs and examine them for information about problem areas. What is of primary interest in this report is the use of idiographs to support the fact that students exposed to resources used in a varying manner by the teachers of the learning centers did different in their achievement.

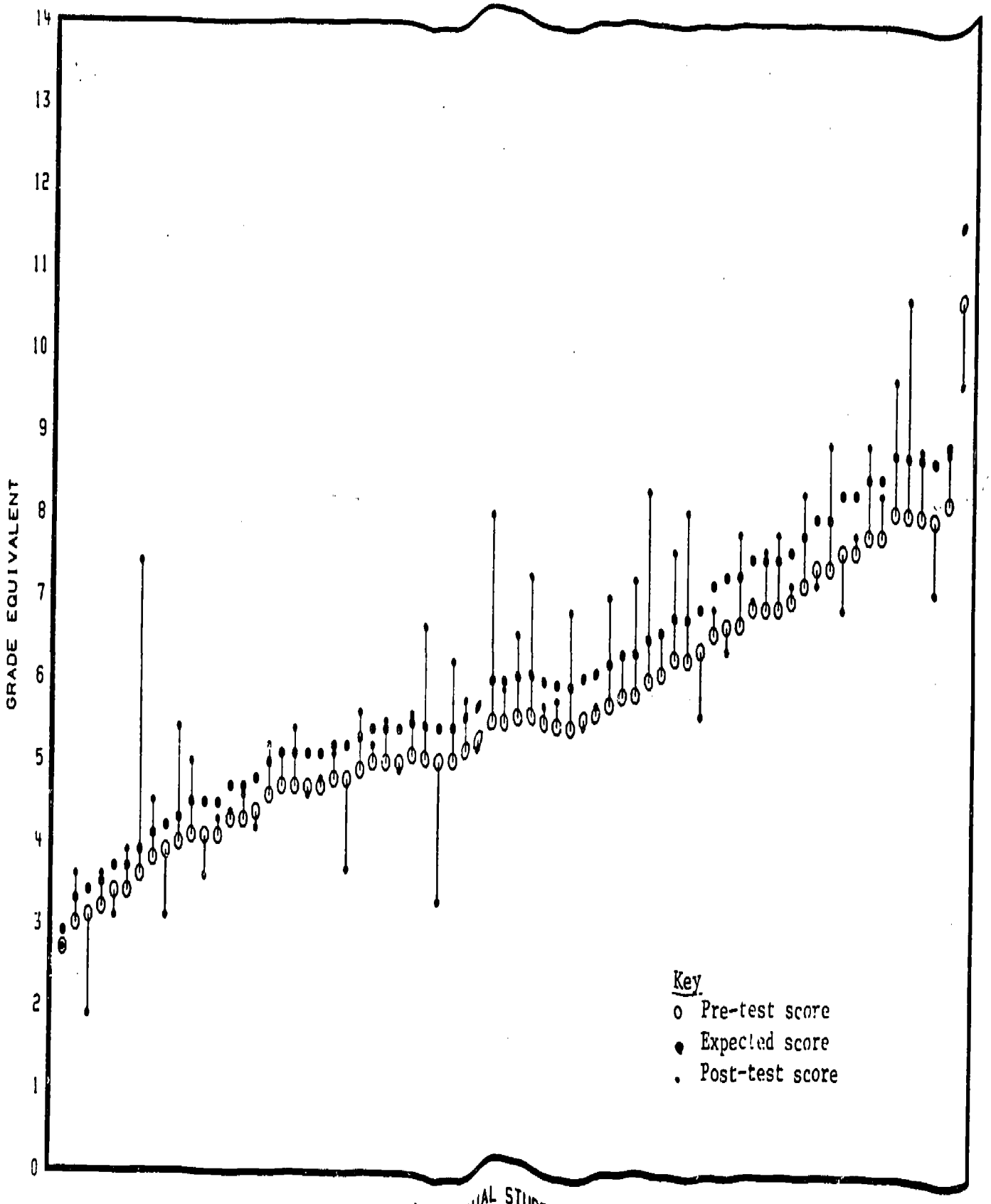

Fig. 2--7TH GRADE READING SCORES-LEARNING CENTER 1

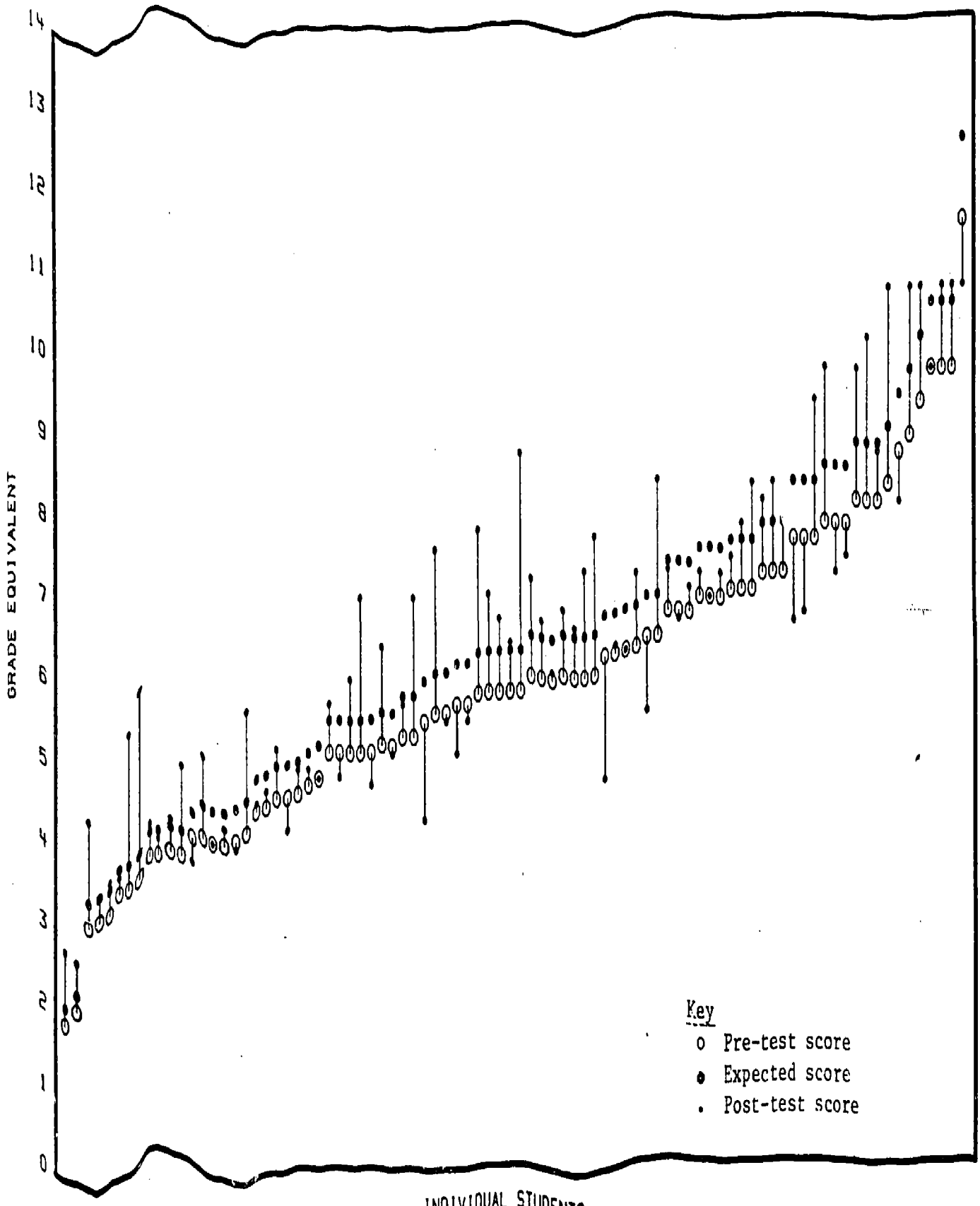

Fig. 3--7TH GRADE READING SCORES-LEARNING CENTER 2

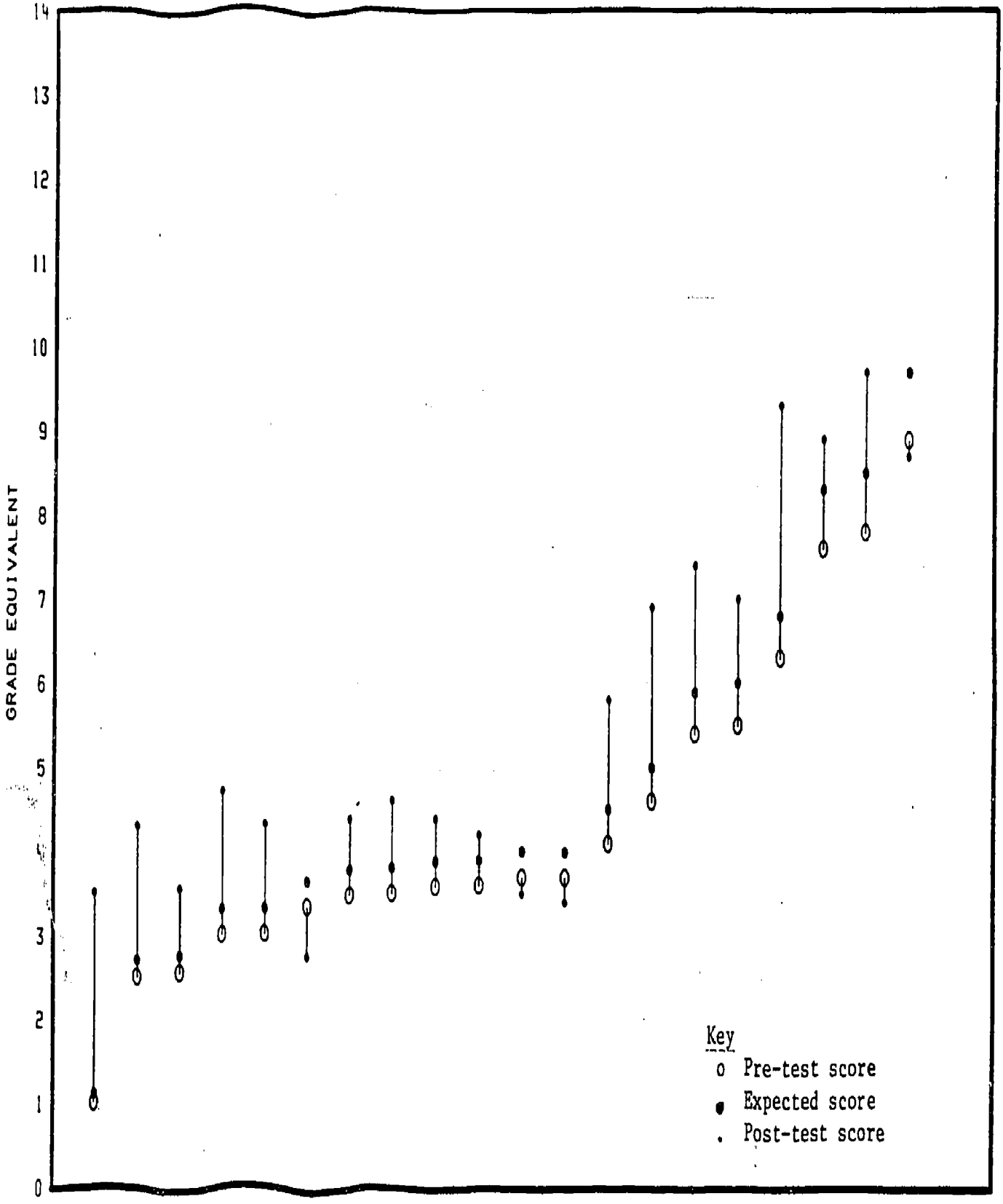

Fig. 4--7TH GRADE READING SCORES-LEARNING CENTER 5/6

IV. AN EQUAL-COST ROUTE TO INCREASED SCHOOL EFFECTIVENESS

INTRODUCTION

Mission High School has succeeded in reversing a trend toward increasing dropouts, excessive truancy, and class-cutting without increasing its operating budget. This has been accomplished by an orderly plan for organizational change. This Section briefly describes the school environment in 1969, outlines the steps taken, under the organizational umbrella of the Mission Educational Community Center, to achieve the turnaround, and discusses the outcomes of their efforts to date.

The Mission Educational Community Center (MECC) has four elements to be implemented sequentially: (1) the learning module, (2) the teacher action module, (3) the educational research module, and (4) the community service module. Each element has three phases: (1) planning, (2) implementation, and (3) continuing evaluation and refinement. The first two modules are of concern here.

A large measure of the MECC success to date is attributable to the introduction of sound management practices and to the cycling of each objective through its three phases, with the continuing evaluation providing feedback for the improvement and refinement of the implementation phase, and suggesting new phases to be considered. A summary of the major activities Mission undertook to accomplish their objectives is followed by a brief narrative giving details of how and why some actions were taken. The chronology of these activities is:

1969-1970

- Identified ten immediate needs and developed a plan to meet them. (Nine solutions approved and implemented.)
- Conducted "fire-fighting" tactics to regain control-stabilization.
- Delineated philosophy, assumptions.
- Examined current practices.
- Developed new models of management and operation.

1970-1971
- o Examined new models of management and operation.
- o Planned a systematic approach (implementation).
- o Planned the learning module.

1971-1972
- o Implemented flexible scheduling.
- o Implemented curriculum identification procedures.
- o Initiated student and teacher survey.
- o Conducted learning module.

1972-1973
- o Developed more effective ways to use resources
  - Phase I--MECC
    - Curriculum identification and development
    - Improvement of instruction-individualization
    - Interdepartmental study groups
  - Phase II--MECC
    - Developed teaching training model
    - Developed teacher resource center
- o Continued the development of administration and management system.

1973-1974
- o Planned for implementation of teacher action module.
- o Continuation of flexible use of time and space.
- o Continuation of curriculum development.
- o Promoted student body interested in student government.
- o Designed computerized period-by-period student attendance (ready for fall 1974 implementation).

FIRST STEPS IN MANAGEMENT CHANGES

In September of 1969, Ted Scourkes took over as principal of Mission High School. He came into a school where the faculty had become more and more "against" any course of action suggested, where slightly more than 10 percent of the faculty was absent each day, where students, rather than the administrative staff and faculty, appeared to be running the school, where the dropout rate was high

and where the overall morale was low. He, with the strong and active support of Mr. Robert Harrington and Mrs. Frances Twoniak, has succeeded in turning the school around. As he looks back, and as the people who were in the former ruins look back, they feel that one administrative ploy was, in great part, responsible for success. The principal *visibly assumed responsibility* for his actions and the actions of his staff and *delegated authority for action* to his staff in an organized and reasonable manner.

The general philosophy was that a school can change without changing the quality and characteristics of the students, and without changing the teaching staff, and that it can be done at minimal cost. Two steps were taken immediately:

1. Time was made available for the faculty and the administrators to plan, and
2. The authority to implement the decisions made in planning was established.

A faculty planning committee, the FPC, was set up. It has seven members, five of whom are elected for a one-year term in the spring to serve for the following fall school year. Two are appointed by the principal; these appointees are very often made to insure some measure of continuity. A faculty member can be elected to the committee for many years in a row. For example, Bob Harrington has served on the Faculty Planning Committee for the past five years. The Faculty Planning Committee essentially serves as staff to the principal, as representatives of the faculty as a whole. They are in almost constant touch with the principal. The entire faculty is known as the Faculty Senate from which is drawn the Senate Executive Council. The Council's job is to run the faculty meetings, and to publish the minutes after the meeting and to develop, on their own, proposals for change. The Senate Executive Council meets occasionally with the principal. In addition, the principal also holds weekly meetings with faculty department heads. The responsibility of the department heads will be discussed later.

On the average, about 50 percent of the faculty regularly goes to meetings. The other 50 percent are what you might call 8-to-3'ers.

They have a job, they do their job, and if everything goes well, they have no complaint. If things not to their liking happen, this 50 percent becomes vocal, but still does not participate.

Mission's first problem was to retake control of the school from the students--that is, create an environment for instruction where class schedules were a reality and the students assigned would attend class. This they did essentially by trying to create a comfortable learning environment. This meant giving students freedom; it meant, as a tactic for providing this environment, flexible scheduling for classes. (The flexible scheduling was also set up because of the possibility of an open enrollment in the District at the time.)

Problem-Solving Procedures

Procedures were established to let ideas surface, or more specifically, to deal with problems. Each problem is studied and for each problem, on one sheet of paper, three solutions giving the advantages and disadvantages of each solution, cost, consequences of each solution are given to the principal by the Faculty Planning Committee. The principal then has three days to respond with his decision. If his decision is negative, he has an additional five days to prepare a statement of the reasons why. Initially, as they began the rejuvenation of Mission High School, the FPC identified specific needs and used them as vehicles to involve the staff in seeking solutions.

An example of this problem-solving effort deals with student dropouts and absenteeism. Three levels of the problem were identified. The first was the dropout, per se--the student who drops out of school completely. The second was the truant--the student who may be out for one or two days, and then back in on a very sporadic basis; and the third was selective attendance, or selective cutting, if you want to look at it negatively. There were several assumptions for each of these levels that led to different solutions for the different levels of student problems. Let's assume that the dropout drops out primarily because he feels he has no voice in what it is he is being asked to do with his lifetime. Based on that assumption, the solution was to give the student as many choices as possible and still retain the control

that the administrators wanted. The solution to the selective attendance problem was based on the assumption that if you can identify early enough what the student thought his problem was, he might be able to do something about this. If there had been attendance period by period, they would have been able to spot a student who was selectively cutting his classes. With that in mind, they set up a period-by-period attendance system on the computer which enables the teachers and the administrators to look at the attendance pattern on a student-by-student basis. This led also to the student relation time program. This program sets aside staff, resources, and rooms where the students can go for counseling and tutoring help if they need it. About 30 percent of the teacher effort in this program was devoted to counseling and crisis intervention, and about 70 percent was devoted to providing alternative activities for the stude

The problem of the truant was more complex. The truant, in terms of behavior, lies someplace between the dropout and the person who is cutting out on a selective basis. They are still in the process of trying to seek a solution to this. They feel at the present time that the main solution to the truant lies in changing the curriculum and that is under way at this time. As of now, they have a rather high student attrition due to the environmental conditions in which the school finds itself. For instance, in August 1974, they had 2117 students; in October 1974, they still had 2117 students, but 350 of them were replacements. This attrition and replacement presents a problem in looking at the total grade and total school achievement measures in terms of average gain for a group. It is very hard to find a whole class that has remained intact for the ten months of the instructional period.

Operational Management Changes

The next important factor is that Mission has changed the way it does business. This change was made under very trying external circumstances. For example, in 1970-71, they had the whole student body scheduled. They knew what classes were going to be given, who was going to teach them, they knew what room they were going to be in, they knew what classes students would be attending, and the number of students

who would be attending each class. That's the way they left the end of June. As the principal said, he was up in the mountains and casually picked up the newspaper to find out what was happening after he had been away for a month, and he read that because of the Field Act (earthquake safety) it was necessary to condemn half of Mission's building. They got together in late August and decided the only solution to this would be to go on a two-shift day, essentially having 12 periods a day instead of 7 or 8. They would use flexible scheduling for the students and for the staff. Some of the staff would start early in the morning and work their required time, and other staff would start later. Each staff member still carried his 40 hours of work per week and each student was still assigned his necessary courses. As far as Mission High was concerned this scheduling worked fairly well. As far as the community was concerned, however, there was a considerable amount of flak. The students, not having a place to go, not having been assigned a classroom, and not having a sufficiently large area to meet in during times that they were not assigned to a specific location, tended to congregate in the streets, sit on cars, smoke, and so forth. The taxpaying community expressed a feeling of unease as to why these students were not in school. In spite of the fact that the flexible scheduling was new to the students and in spite of the fact the community didn't like the looks of the students in the street, the new freedom the students had and the feeling that they had that they were trusted led to a decrease in the selective cutting and a general feeling of "We're in this thing together."

An illustration that Harrington gave was that in the years prior to 1969, and in 1969, first year of turnaround, the students were openly antagonistic toward anyone of the faculty or the administrative staff. It was not uncommon to find students blocking the door and making no effort to move. He said, now when he comes into the building, it is not unusual for a student to hold open the door and say "Good morning." That's just a small piece of evidence of impact of the change in the environment for the students.

Because the students were visible in the streets, the parents and the community questioned what was going on. Before 1969, the community

and the parents would tackle any faculty member from Mission coming in any door at any time to voice their complaints. They had no focal point to use in seeking an answer to their problems. One of the things that Scourkes did was to essentially put himself in the "hot seat," to use his words. When the community or the parents had any complaint about anything related to Mission High School, they saw him. His door was open, he accepted all of the blame, he dealt with all the problems through his actions or through the actions of the Faculty Planning Committee. It didn't take long for this to become a reality as far as the community was concerned. And it is a rather interesting idea. Here you have the man at the top who theoretically does bear the responsibility for the actions of his staff, literally taking that responsibility, giving his staff members the authority to do something about problems and then supporting them. The principal mentioned that he was taking the blame for things as they happened, but Harrington, who is essentially working for Scourkes as a staff member, said that the faculty at first didn't believe this. It took some time for trust to build up between the principal and his administrative staff and the faculty at large.

Mission still has problems they are working on. One of them is to get a viable career education program going; another is to increase or maintain an institutional identity or institutional pride within the students and the faculty; another, as we mentioned before, is the curricular changes they feel are necessary to deal with the truancy problem.

REPLICATION OF MISSION PRACTICES IN THE DISTRICT

The interesting question is, "If Mission is making these changes successfully, why aren't other schools?" The principal's feeling was that very few people know how to go from an idea to practice. And he said, as far as other schools in the San Francisco district doing what Mission is doing, they need first to become aware of what Mission is doing. Apparently, over the last five years, there has been no organized effort to publicize what Mission is doing. Another reason, mentioned by Harrington, is that you need an administrator strong enough within himself to be able to delegate the authority to do something, knowing

he retains the responsibility. Again, this is a standard management tenet, but apparently not a usual school management practice.

Another reason might be that although the central district is aware of what Mission is doing, no reason is seen to document what has happened at Mission, or to figure out if there is a way to replicate appropriate aspects of the Mission program in other high schools. For example, two high schools last year were told that they had to cut back on their space because part of their physical plant was unsafe vis-á-vis earthquakes. As a result, these schools had to go on the same type of double scheduling that Mission had gone through a couple of years ago. Instead of going the flexible scheduling route using Mission's example, these schools just simply went on double sessions. Rumor has it that some teachers are teaching three periods a day rather than six, but as long as they get paid for six periods and only have to work three periods, they're not going to complain. In sum, you have, in Mission experience, a workable model for making the best use of reduced physical plant capacity. You have two schools that are facing the same problem that Mission was, but the District doesn't say to School X, "Why don't you go over and find out what Mission did?" Assume that the faculty of School X came over and talked to the Mission staff to find out what they did what might happen? If the principal at School X has not established his willingness to accept the responsibility for the action of his teachers, then the teachers would be foolhardy to implement, or even suggest, a Mission-like approach to the problem. Perhaps the faculty of School X knew that their principal would not say, "Now, let's go ahead and do this, if it works out well you can get credit, and if it bombs out I'll take the blame." Mission could not stay where they were (in half of their existing building) because the building was going to be remodeled on the same site, so they moved about fifteen city blocks away to the cite of the former Polytechnic High School.

Why was Polytechnic High's facility available? (Now if we look at Polytechnic as members of the Mission School, we see things happening there that precede Mission events by three or four years.) Its enrollment had dropped steadily. By 1972, enrollment had dropped to the point where Polytechnic High could be absorbed in another school,

and Mission could take over the Polytech plant which they did. Mission will remain at the Polytechnic site (temporarily named Mission High) until their new remodeled building is ready in September 1976. But looking at Polytech's history, which as mentioned is the precursor of Mission's, gave Mission an added incentive to turn their school around. They were seeing what could happen to a school whose enrollment declined. So here we have an example of Polytech lending itself as an incentive to Mission to changes in its way of life.

ALLOCATION OF FACULTY TIME

The allocation of faculty time at Mission has changed. Five years ago there was a 35-period week with 25 periods of classroom contact, 5 periods of lunch, and 5 periods of preparation for each teacher. Now there is a 50-period weekly *school* schedule with each teacher being scheduled for 40 periods. The typical teacher has 20 periods of classroom contact, 6 for preparation, 2 periods for department meetings, 2 periods for general faculty meetings, 5 periods for "other assignments," and 5 periods of lunch. The 5 periods of "other assignment" were, in essence, taken out of the classroom contact periods, so that each teacher instead of having 25 periods of classroom contact, as they did five years ago, has only 20 periods. What kinds of things are approved as other assignments? Mission has a list of school activites, instructional support activities, instructional activities, and extracurricular activities that qualify to be selected by the teacher for 5 periods a week--1 period or more a day for "other assignments."

How is the schedule of classes made out? The scheduling of classes, the number of class hours to be offered, and the number of sections in each class, and the subjects that are to be offered begins just before each semester. It starts with teachers being asked by their department head what courses they would like to offer in the next semester. These courses are then listed and provided to the students. The students select courses they would like to take, knowing that they have to meet certain requirements which are spelled out for them. This information then goes back to each department head by subject. The department head then makes teacher assignments in a democratic way; in other words,

all teachers participate and react and interact, and compromise, etc., until a class schedule is worked out for that department. This also takes into account, at that time, the activities the teachers want included in their other assignments. It works well in most cases; the larger the department, the more easily it can resolve its problems around the table.

The differences in teacher classroom contact allocation between the 1974-75 school year and the 1971-72 school year are shown in Table 13. Mission High took the model Rand developed for San Francisco in 1971-72 and put it on their computer, using the same approach but more detail to show the allocation of teacher resources to instruction, to instructional support, and to administration.

Table 13

MISSION HIGH SCHOOL CHANGE IN ALLOCATION
OF CLASSROOM CONTACT PERIODS
(in percent)

Class	1971-72	1974-75
English	17.4	16.3
Foreign Language	2.3	2.7
Mathematics	9.2	8.6
Social Studies	13.2	10.2
Science	8.2	11.3
Business	8.2	7.7
Art/Music	3.0	3.1
Creative Arts	1.5	4.2
Industrial Arts	4.9	7.0
Driver Education	4.8	1.4
Careers/Vocational	5.1	3.6
Physical Education--Girls	6.1	7.5
Physical Education--Boys	6.1	8.4
Special Education	10.0	8.0
Total	100.0	100.0
Class hours	1780	1830

Another outcome of the changed teaching environment at Mission has to do with opening the school to outsiders. In the pre-1969 period, there seemed to be a closedness about the school. It was felt that

they couldn't stand scrutiny or the risk of outside visitors. Now, Mission has outside discussants in different occupational and professional fields come in through their career education program.

WORK EXPERIENCE PROGRAM DEVELOPMENT

They also have a large work experience program with about 20 percent of their student body employed on a part-time basis. That's a rather high percentage. Students have to take 30 units a year. They can schedule 20 units in one semester and 10 in the next or 15 and 15 or however they want to do it; this enables them to be free to take a morning job or take a job at different times during the day, or take a job in the afternoon and go to school in the morning. One of the outcomes that has resulted from Mission's new look is that by early summer enrollment at Mission is closed; it has been this way for the past three years. It's not that they have been cut down in terms of the number of students they can handle as much as it is that they are attracting more students. The same applies to the staff. Each year the number of applications to teach at Mission has increased, and at this time, Mission has a waiting list. They have a waiting list of teachers who want to teach where they are right now (the old Polytechnic High location), and they have teachers who feel that when Mission returns to its remodeled building they will have the need for more teachers.

EFFECTING MISSION'S INCREASED EFFECTIVENESS

In discussion, we have delineated several dimensions along which the effectiveness of Mission High School as a whole has increased. These include an increase in the number of teachers who are applying for teaching positions at Mission, a decrease in teacher daily absenteeism, a decrease in student dropout, truancy, and selective class cutting, a discernible increase in student satisfaction with the school and an increase in the school's productivity as measured by class hours from 1780 to 1830. The most dramatic change has been in the learning environment itself. As mentioned earlier, one of the changes that Mission made had to do with the allocation of teacher time. This had a direct impact on the students because the changes

that provided a mechanism for students and teachers to interact were both more informal and more timely. The school set up what they termed a student-relation program for student-relation time, known as the SRT effort. In this program, classrooms were set aside as resource rooms or tutorial labs. Teachers were scheduled to man these classrooms, but the students were not scheduled or assigned to the classrooms. In the program as a whole, the teachers spend about 70 percent of their time in these classrooms and 30 percent of their time on one-to-one student counseling, and what might be termed "crisis intervention." As a matter of fact, the school views the student use under the SRT program as one of its measures of success. Remember that the students are not assigned to these rooms and yet the rooms are usually used to capacity. The chance for the students to get to know the teacher and to be aware that the teacher is interested in the student's problems is apparently appreciated by the students.

Since then, what Mission has done is to change those factors over which the school has control. This is in line with the findings of a study released by the State of New York's Office of Education Performance Review. This study, *School Factors Influencing Reading Achievement: A Case Study of Two Inner City Schools*,* considered two schools which were matched according to family income, percentage of families on welfare, pupil ethnicity, percentage of pupils with second language difficulties, percentage of pupils eligible for free lunches and pupil mobility. The study then determined on the basis of reading achievement the more effective of the two schools. They then looked for factors that might explain the difference in effectiveness in the two schools. The study showed that the differences in student performance seemed to be attributed to factors under the school's control. This is much the same finding as at Mission. It was found in the New York Study that the administrative behavior, policies and practices in the schools appeared to have a significant impact. The more effective school was led by an administrative team which provided the good balance between management and instructional skills. Again, this is the situation

*State of New York Office of Education Performance Review, *School Factors Influencing Reading Achievement: A Case Study of Two Inner City Schools*, March 1974.

at Mission where they found that the students responded to the educational environment and the learning environment. Other findings included teacher expectations, that is, if the teachers were pessimistic about their children's potential, the children simply failed because they were not expected to succeed. In the more effective school, it was found that the teachers seemed to be confident about their ability to have an impact on the students. The study also found that the classroom instruction does not appear to differ between the two schools. A study published in March 1974 carried the caveat that the findings are preliminary and should be viewed as springboards for further exploration in other schools and in other districts. Even so, it would appear that the Mission experience closely parallels the findings of the New York School Study.

In a 1972 study, Kenneth Clark found that certain behaviors of a principal seem to be characteristic of effective schools. These are:

- Sets and implements established curriculum and performance goals.
- Has high expectation of his teachers and insists on regular diagnostic assessment of student performance.
- Helps his staff to reenforce their strengths and correct their weaknesses through workshops, staff development, direct supervision.
- Keeps in direct touch with classroom performance.
- Involves teachers in program planning.
- Defines roles and responsibilities clearly.
- Focuses on student performance rather than classroom control as primary.*

Over the course of the past few years, Mission High School has succeeded in turning itself around. They have reversed a declining enrollment trend. They have decreased dropout rates, they have in essence improved the educational environment of the school. They have done this primarily with management changes. For the most part, they

*Clark, Kenneth B., *A Possible Reality*, Emerson Hall, New York, 1972.

have done this at no additional cost. At this time, Mission is involved in changing the curricular offerings, and in an effort to increase student involvement in the decisionmaking processes of the school. The results of these latter efforts are not yet available. It would appear, however, that Mission has found a successful key to increasing the overall effectiveness of the school within the same level of resources. This is further supported by observations from another discipline.

Twelve reasons for failure of change efforts have been identified by Lippitt in *Organizational Renewal*,* These are:

1. When the purpose of the change is not made clear;
2. When persons affected by the change are not involved in the planning;
3. When an appeal for change is based on personal reasons;
4. When the habit patterns of the work group are ignored;
5. When there is poor communication regarding the change;
6. When there is fear of failure;
7. When excessive work pressure is involved;
8. When the cost is too high, or the rewards inadequate;
9. When anxiety over job security is not relieved;
10. When vested interest of the individual or the subunit of the organization is involved;
11. When there is lack of respect and trust in the initiator;
12. When there is satisfaction with the status quo.

The systematic procedures for change implemented by Mr. Scourkes, Mr. Harrington, and Mrs. Twoniak with the help of the Faculty Planning Committee were supported by the positive aspect of these reasons for failure--the conditions for success. For example, a dissatisfaction with the status quo of Mission High School led to change; the purpose was made clear. The persons affected by the change were involved in the planning and there was good communication among all participants. Now it is vigorous and highly skilled in working to overcome the forces responsible for the abominable situations which presently exist in the

*Lippitt, Gordon L., *Organizational Renewal*, Appleton-Century-Crofts, New York, 1969.

large majority of inner city schools.* Levine urged that the principals communicate with their faculties the need for teachers to provide structured and consistent learning environments for educationally disadvantaged youth. Again, Mission's principal took this action. In addition, it is apparent from talking to Mr. Harrington and Mrs. Twoniak that the communication link between the principal and the faculty was a very active two-way street. The contribution made by these two staff members and the Faculty Planning Committee that was set up early in the MECC program should not be underestimated.

ACTIVITIES OF THE PRINCIPAL IN IMPLEMENTING THE MECC PROGRAM AT MISSION

Most of the actions specified by Clark were taken at Mission. In an earlier study, 1966, by Levine, it was found that "an adequate level of education in a low income school is not likely to be obtained unless its administration was made clear, the persons affected by the change were involved in the planning and there was good communication among all participants."

Mission's success in turning the school around deserves a more in-depth study by proponents of organizational development or implementation analysis. As a microcosm reflecting many problems of the district as a whole, Mission offers the district an opportunity to identify successful strategies leading to increased effectiveness in the use of educational resources.

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*Levine, Daniel U., *Raising Standards in the Inner City Schools*, Council for Basic Education, Occasional Papers #11, December 1966.

Appendix A

REVIEW OF RESOURCE/EFFECTIVENESS STUDIES

(This review was written as a precursor to Rand's proposed research on resources/effectiveness relationships in education and provided the basis of the methodological departures of the research strategy.)

Within the past few years, three studies have extensively reviewed the literature on the relationship between inputs and outputs in education. Two of these studies agree in their conclusions that "no single resource consistently appears to exert a powerful influence on student outcomes,"* and that "this evidence suggests that school resources have small inconsistent effects on achievement."† A third survey, however, reaches quite different conclusions, namely that "we are impressed with the amount and consistency of evidence supporting the effectiveness of school services in influencing the academic performance of pupils."‡

Many of the reviewed studies show at least one resource variable related to educational outcomes in a statistically significant manner. Guthrie, et al., lists 17 studies in which resources are important. So long as the term "resources" is broadly defined to mean "at least one resource," the statement of Guthrie, et al., that resources make a difference (quoted above), can be supported. But when one considers each variable in detail, inconsistencies arise. Several examples shall be considered.

Teacher characteristics are frequently cited as important resources. These characteristics include experience, salary, academic achievement, and verbal ability. In the 17 studies cited by Guthrie, et al., teacher experience appears as the most frequently important variable, being

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*Averch, Harvey, S. J. Carroll, T. S. Donaldson, H. J. Kiesling, J. Pincus, *How Effective is Schooling? A Critical Review and Synthesis of Research Findings*, Educational Technology Publications, June 1974.

†Jencks, Christopher, et al., *Inequality: A Reappraisal of the Effect of Family and Schooling in America*, New York, Basic Books, 1972.

‡Guthrie, James W., George B. Kleindorfer, Henry M. Levin, and Robert T. Stout, *Schools and Inequality*, M.I.T. Press, Cambridge, 1971.

significantly related to educational outcomes six times. But being in their own research Guthrie, et al., found a teacher's experience to have the smallest significance.* Nineteen studies were described by Averch, et al. A teacher experience variable was included in 13 of these. The variable was clearly significant in three cases, sometimes significant in four more and insignificant in six cases. Teacher experience was important in Thomas,† Hanushek‡ (1968), and Katzman.** The variable had a weak effect in Coleman†† (stronger for Southern Negroes); it was significant in two out of 14 equations in Burkhead, Fox, and Holland,‡‡ 18 out of 127 equations in Kiesling*** (1970), and 5 out of 15 equations in Michelson.††† The important fact to highlight here is that while experience was often statistically significant, just as often it was insignificant. This pattern is repeated for the other teacher variables with the proportion of significant cases even smaller than that observed with experience.

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*Guthrie, op cit.

†Thomas, James Alan, "Efficiency in Education: A Study of the Relationship Between Selected Inputs and Mean Test Scores in a Sample of Senior High Schools," Ph.D. dissertation, Stanford University Library, 1962 (microfilm).

‡Hanushek, Eric, "The Education of Negroes and Whites," Ph.D., Dissertation, Massachusetts Institute of Technology, 1968.

**Katzman, Martin T., "Distribution and Production in a Big City Elementary School System," *Yale Economic Essays*, 8, Spring 1968, 201-256.

††Burkhead, Jesse, Thomas G. Fox, and John W. Holland, *Input and Output in Large City High Schools*, Syracuse University Press, Syracuse, 1967.

‡‡Kiesling, Herbert J., *A Study of Cost and Quality of New York School Districts*, U.S. Department of Health, Education and Welfare, Office of Education, 8-0264, Washington, D.C., February 1970.

***Michelson, Stephan, The Association of Teacher Resourceness with Children's Characteristics," in *How Do Teachers Make a Difference?*, U.S. Department of Health, Education and Welfare, Office of Education, Bureau of Educational Personnel Development (OE-58042), 1970, 120-168.

†††Mollenkopf, William G. and S. Donald Melville, *A Study of Secondary School Characteristics as Related to Test Scores*, Research Bulletin RB-56-6, Educational Testing Service, Princeton, 1956.

Turning to another teacher variable, many studies examined the effect of class size or pupil-teacher ratio. One or the other (or both) of these variables appeared in 12 of the 19 studies described in Averch, et al. The variables were significant with the correct sign in two cases,*† significant with the wrong sign once,‡ partially significant in two studies,** and insignificant seven times.††

It may be argued that even though no single teacher variable is consistently important, at least *one* teacher attribute almost always has a significantly strong effect. However, even this level of generality cannot be supported. For example, Coleman found that seven teacher characteristics contributed only a small percentage of explanatory power to the test scores of whites (between 1 and 2-1/2 percent) and somewhat more for Negroes (between 3 and 8-1/2 percent). Smith's reanalysis of the Coleman data corrected a number of errors in the original report. In four equations for 9th and 12th grade northern blacks and whites, no teacher characteristic was important in any equation, and in general teacher characteristics were insignificant.

This same pattern is repeated for other resource variables such as building age, special facilities, special staff, library books and so forth. Some resource variable is often significant, but not consistently across studies. If a regression with 20 variables was run on a random sample, there is a 65 percent probability that at least one

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*Thomas, op. cit.

†Mollenkopf, William G. and S. Donald Melville, *A Study of Secondary School Characteristics as Related to Test Scores*, Research Bulletin, RB-56-6, Educational Testing Service, Princeton, 1956.

‡Kiesling, Herbert J., *The Relationship of School Inputs to Public School Performance in New York State*, P-4211, The Rand Corporation, Santa Monica, October 1969.

**Bowles, Samuel, *Educational Production Function*, Final Report, U.S. Department of Health, Education, and Welfare, Office of Education, OEC-1-7-00451-2651, ED 037 590, Harvard University, Cambridge, February 1969.

††Averch, Harvey and Herbert Kiesling, "The Relationship of School and Environment to Student Performance: Some Simultaneous Models for the Project TALENT High Schools," The Rand Corporation, Santa Monica. 1970 (mimeo.).

variable would be found significant at the five percent level. Many of the reviewed studies had many more than 20 variables, and usually many different studies had many more than 20 variables, and usually many different regressions were estimated (sometimes more than a hundred). Thus, the findings of the inconsistently significant variables noted above could be found in randomly generated data. Even when the resource variables are statistically significant, they seldom have a strong effect.

Despite the lack of significance of any individual resource, it may be that there is an impact when they are considered in their totality. The variable that would seem to most nearly accomplish the task of adding up all resources is total expenditure per pupil. But the same result is again observed--after accounting for SES, expenditures have no discernible effect. The absence of expenditure effects is especially strong when "value added" or "gain" dependent variables are used.*

Value added is one way to approach the difficult problem of accounting for variations in tastes and aptitudes associated with different levels of SES. The use of different proxy measures of SES introduces a spurious variability to the statistical results. For example, high schools with high expenditures get high scoring students from high SES families. Adjusting of SES by family income will generate a different result than if occupation or minority status or ownership of an encyclopedia was used as the SES variable. However, if test scores for two points in time were available for the same population, one could estimate the relationship between differences in the change in scores--the value added--and expenditure differences. The level of test scores, through which the analytical problems were introduced, no longer enters the analysis. Many of the strongest and complicating effects of SES are thereby removed. Only a few studies have used the value added technique, mainly because of the lack of the

*Jencks, op. cit.

necessary time series data.*† Value added scores, however, have themselves been severely criticized and some authors see no advantage in using this technique.‡

The research studies discussed above were conducted under the assumption that a given structure or model explained the observations of a given sample. In other words, the research assumes that some underlying process generates the phenomena being analyzed and that the features of the process can be determined statistically. Some events, however, do not fit this mold. A large number of programs have injected resources into a system with the explicit purpose of doing things differently, of establishing a new structure. This has been the case of various intervention programs financed by the federal government. Head Start and Title 1 of the Elementary and Secondary Education Act of 1965 are the principal examples of such programs and a substantial evaluative literature has attempted to assess the impact of these programs. Since the intent of these programs has been to alter the structure of educational systems through the development of new programs or the alteration of old ones, any changes in educational attainment that resulted could have been due to *either* the new resources or new processes. In fact, though, most Title I projects did not change structure, but merely added to one or another of the conventional resources. One survey of the evaluative literature decided that there is very little evidence in the process of children from disadvantaged environments."** Jencks, et al., were led to conclude that "the results of evaluations appear to be virtually random. Title I programs

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*Burkhead, Fox, and Holland, op. cit.

†Hanushek, Eric, *The Value of Teachers in Teaching*, RM-5363-CC/RC, The Rand Corporation, Santa Monica, December 1970, and Kiesling (op. cit.) used the value added approach.

‡Cronbach, L. J. and L. Furby, "How Should We Measure 'Change' -- or Should We?" *Psychology Bulletin*, 74, 1970, pp. 68-80.

**Averch, et al., op. cit.

are worse than the status quo as often as they are better.* In addition, short-run gains from the educational intervention programs tended to fade away after two or three years. Nevertheless, with the hundreds of projects financed by the federal programs, a few were successful. These typically spend considerably more per pupil than the average project--generally more than $250. Averch, et al., concluded that since numerous other interventions funded at these higher levels have failed, "clearly the level of funding is not itself a sufficient condition for success."

A common problem of the intervention experiments, however, may vitiate the general finding of low effectiveness. Most of the children entered in these programs have been the most disadvantaged children. In comparison to the control groups (of likely greater ability), the program groups did not clearly benefit from the program. However, it has been pointed out that equals were not compared to equals and the conclusion that the interventions made little difference could be seriously biased. A recent report suggests that within the intervention programs (specifically California Title I programs), variations in specialized reading resources have a measurable effect on reading outputs.† Kiesling's study addresses many of the other problems raised in this section. The application of resources directed toward a specific goal was measured by minutes of teacher time per student. Variations in resource mix were accounted for by inclusion, as separate variables, of the various alternatives of reading specialist, classroom teacher, and assistants. Teacher effort outside the classroom was addressed by looking at hours of planning. Unfortunately, a single 'cost' figure for the alternative resource mixes was estimated and matched with the corresponding reading gains. This had the effect of obscuring the resource/effectiveness relationships. This one study, however, has taken a step toward making up the input measurement.

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*Jencks, et al., op cit.

†Kiesling, Herbert J., *Some Estimates for the Cost-Effectiveness of Educational Inputs for Reading Performance of Disadvantaged Children in California Title I Projects*, P-4867, The Rand Corporation, March 1972.

deficiencies noted in earlier studies. A later study (Kidder and Kiesling--now in process) offers promise along the same line. But here, again, the regression analysis approach may obscure the very relationships being sought.

CONCLUSIONS

It is necessary to agree with the findings of Averch, et al., and Jencks, et al., that research has not demonstrated that school resources have a consistent and strong impact on educational outcomes. An important qualification must be made to this conclusion. Because many of the serious problems inherent in this area of research have not been successfully solved, it is not possible to say whether the research describes the world well, or whether critical defects in research design or in the data have precluded our really knowing the world. It can be said that, based on the conceptual models on which past research has been based, as tested by the data, resources do not seem to make a difference.

The critical problems of previous research provide "loopholes" that encourage further research to illuminate the many unresolved problem areas. Concentrating on the input problems described above, a major requirement for future research is that it be conducted at as disaggregated a level as possible. Second, so far as possible, only those resources that are actually applied should be measured. Third, attempts should be made to identify differences in generically similar resources. Fourth, resources aimed at specific educational outcomes should be matched with those outcomes. Fifth, and perhaps most difficult, new conceptual methods should be developed and tested.

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Appendix B

LETTER FROM PARTICIPATING SCHOOL DISTRICT

SAN FRANCISCO UNIFIED SCHOOL DISTRICT
OFFICE OF SUPERINTENDENT
135 VAN NESS AVENUE
SAN FRANCISCO, CALIFORNIA 94102
Telephone: (415) 863-4680

March 26, 1974

Mrs. Sue A. Haggart
The Rand Corporation
1700 Main Street
Santa Monica, California 90406

Dear Mrs. Haggart:

I am writing this letter to express the interest of Everett Junior High School and Mission High School in working with The Rand Corporation in a research project which will attempt to explore, in depth, the potential relationships which exist between resources and outcomes within educational programs.

We are desirous of taking a far deeper look at the relationship between resources and program outcomes. Rand is proposing to take an in-depth look at two schools in terms of the resources connected with specific educational programs. Outcomes will be measured in terms of student achievement and by other measurements such as attitude inventories developed by Rand and school-site staff working cooperatively during the year of the study.

Such data is presently unavailable and is of great importance in considering the allocation of educational resources. It would be very much in the interests of the Unified School District for Everett Junior High School and Mission High School to participate as suppliers of data and members of the research team with The Rand Corporation if such a project is funded in total by the National Institute for Education.

Sincerely,

Dr. Lane DeLara
Acting Superintendent of Schools

LDL:vl

Appendix C

TECHNICAL APPENDIX FOR MULTIVARIATE ANALYSIS

This appendix is devoted to a fuller reporting of the results of the multivariate analyses discussed in Section III. The appendix does not attempt to elucidate the mathematics of multivariate analysis since these are discussed fully elsewhere. The reader is referred to Bock and Haggard (1968), Finn (1974), and Tatsuoka (1971) for a comprehensive treatment of multivariate analyses. Similarly, the logic of experimental designs is thoroughly covered in Winer (1971) and in many other sources. Again, it must be emphasized that the data used for the analysis did not come from a true experimental design. Thus, the analyses are of an exploratory nature rather than confirmatory. The underlying philosophy in these analyses is that exploratory research of the type implemented here is probably the only practical approach that can be used in natural educational settings and that the information gleaned from such analysis is far from being valueless.

The analyses consisted of two parts: (1) hypothesis testing and (2) estimation in the least-sqaures sense. Finn's (1968) MULTIVARIANCE program (version 4) was used throughout. Both factors in the analyses of variance, feeder school, and learning center were considered as fixed factors. Thus, the pooled within-group variance-covariance matrix was used for tests of significance. Three analyses are reported. The first analyzed pre-test scores (reading, language, mathematics, and study skills). The second analyzed post-test scores on the same four tests. The third analyzed post-test scores while controlling for pre-test scores. Multivariate analysis of variance was used throughout since the four dependent variables, reading, language, mathematics, and study skills, were obtained from the same subjects, are thus correlated in some arbitrary and unknown manner, and repeated F-tests are not statistically independent. No exact probability that at least one of them will exceed some critical level on tbe null hypotheses can be calculated. The multivariate tests, on the other hand, are based on

sample statistics which take into account the correlations between variables and have known exact sampling distributions from which the required probabilities can be obtained. After significant departures from the null hypotheses have been demonstrated, the differences between treatment effects are estimated using least-squares techniques and inspected to determine the direction and relative sizes of the effects on each of the dependent variables.

A two-way multivariate analysis of variance or covariance (5 learning centers and 14 feeder schools) including the interaction was tested in each analysis. The analysis of variance model may be expressed as

$$Y_{ijk} = \mu + \alpha_j + \beta_k + \alpha\beta_{jk} + \varepsilon_{ijk} \qquad (1)$$

where all terms represent vectors. Y_{ijk} is a vector of test scores on the four dependent measures; μ represents the general mean of each response variable; α_j represents the effect of the 5 learning centers; β_k represents the effect of the 14 feeder schools; $\alpha\beta_{jk}$ represents the interaction between the feeder schools and learning centers; and ε_{ijk} represents discrepancies or errors between the observed vector response and the vector sum of the general mean, main-class effects, and interaction.

The analysis of covariance model may be expressed as:

$$Y_{ijk} = \mu + \alpha_j + \beta_k + \alpha\beta_{jk} + \Gamma x_{ijk} + \varepsilon^*_{ijk} \qquad (2)$$

where the additional term Γx_{ijk} represents the coefficients of the multiple regression equation for the regression of the post-test scores on the pre-test scores; the error term ε^*_{ijk} represents discrepancies between the observations and the larger model.

ANALYSIS OF PRE-TEST SCORES

Significance testing was carried out in several ways on the pre-test scores because of the nonorthogonal nature of the design. Non-

orthogonality of the design was due to some empty cells and unequal cell sizes. There were eight empty cells in all. Thus the rank of the model for significance testing, and the total degrees of freedom for all between-cell hypotheses, including one for the grand mean, had to be reduced from possible 70 to 62. The same approach had to be used for the analysis of post-test scores as well as the analysis of covariance. Since the design is nonorthogonal and effects are tested in a stepwise fashion, the order of effects is important. [See Finn (1974), p. 298; pp. 325-326.] Several orders were used. One order first tested the learning-center effect, followed by feeder-school effect, followed by the interaction. A second order tested the feeder-school effect, followed by the learning-center effect, followed by the interaction. Finally, the interaction was tested first, followed by the learning-center effect, and the feeder-school effect. All orders produced the same result. Learning centers and feeder schools were important factors but not the interaction. Results of the multivariate F-tests of equality of mean vector for various effects is reported in Table C.1 for the first order described above.

Table C.1

F-RATIOS OF MULTIVARIATE EQUALITY OF MEAN VECTORS ON PRE-TEST SCORES

Item	Degrees of Freedom	F	p Less Than
Learning-Center Effect	16/550	3.36	.0001
Feeder-School Effect	52/699	1.70	.0021
Interaction	176/721	1.14	.1200

These findings indicated that a model including only main-class effects was appropriate for estimation. Thus a model of rank 18 was fitted to the data which included the general mean, the learning-center effect, and the feeder-school effect. This new model was re-estimated using the MULTIVARIANCE program. Two types of contrasts were used in the design of the contrast matrix. Learning centers were compared using simple contrasts which compare all groups to the

group omitted which, in this case, was Learning Center 5/6 (combined). Feeder schools were compared using deviation contrasts. These compare feeder schools to the overall mean for feeder schools. For a fuller description of contrast types see Finn (1974). Tables C.2 and C.3 report least-squares estimates of effects and their standard errors, respectively. Least-squares estimates could be tested for statistical significance, individually using a t-test or rowwise using an F-test, but since there are problems with this approach, they are reported here only as descriptive measures.

Interpretation of least-squares estimates is straightforward. Turning to Table C.2, we see for instance, that the least-squares estimate for Learning Center 1 is .72 on reading. This tells us that Learning Center 1 is .72 grade equivalents above Learning Center 5/6 (combined) on the reading test. Moreover, our best estimate of this learning center's pre-test learning score is the general mean plus the estimate for the learning center--i.e., 5.06 + .72 = 5.78 grade equivalents. Since we have used deviation contrasts for feeder schools, the interpretation of least-squares for these is somewhat different. The least-squares estimates for feeder schools tells us how much above the mean for all feeder schools a particular feeder school is. For instance, if we look at the least-squares estimate for Webster School on language, we see it has a value of -1.29. This tells us that Webster School is 1.29 grade equivalents below the overall mean for all feeder schools on language. Perusal of the complete table indicated some interesting trends. First we notice that on most measures Learning Centers 1 and 2 are considerably higher than other learning centers. Here Learning Centers 5/6 are the baseline and have a baseline value of zero. Secondly, on the feeder schools we see that the Filipino Educational Center and Webster School tend to be considerably lower than feeder school mean while Gratton School tends to be considerably higher than the overall mean for feeder schools.

ANALYSIS OF POST-TEST SCORES

This section covers the analysis of variance of post-test scores as well as the analysis of covariance. The multivariate analysis of

Table C.2

LEAST-SQUARES ESTIMATES OF EFFECTS FOR PRE-TEST SCORES
FITTING A MODEL OF RANK 18

Item	Reading	Language	Mathematics	Study Skills
General Mean	5.06	5.05	5.25	4.84
Learning Center 1	.72	1.06	.69	.61
Learning Center 2	.73	1.13	.76	1.06
Learning Center 3	- .46	- .37	- .49	.80
Learning Center 4	- .05	.41	.40	.5
Filipino Educational Center	-1.18	- .5[illegible]	- .07	- .64
Unknown	.10	- .06	- .32	- .36
Carmichael	- .29	.02	.14	- .20
Henry	.41	1.25	.50	.20
Clarendon	.32	.70	.35	.54
Gratton	1.28	1.25	.64	1.69
King	.20	- .14	.[illegible]7	.11
Webster	- .95	-1.29	- .[illegible]2	- .75
Laguna Hondo	.70	.49	- .16	.27
Rooftop	.16	- .72	.03	- .30
Other	.46	- .16	.08	.13
Redding	.03	- .07	.20	.37
Jefferson	- .32	- .35	- .37	- .54

Table C.3

STANDARD ERRORS OF ESTIMATES OF EFFECTS FOR PRE-TEST SCORES FITTING A MODEL OF RANK 18

Item	Reading	Language	Mathematics	Study Skills
General Mean	.12	.14	.11	.14
Learning Center 1	.29	.33	.26	.32
Learning Center 2	.28	.32	.26	.31
Learning Center 3	.37	.42	.34	.40
Learning Center 4	.41	.46	.37	.44
Filipino Educational Center	.48	.54	.44	.53
Unknown	.40	.44	.36	.43
Carmichael	.26	.29	.23	.28
Henry	.46	.52	.42	.50
Clarendon	.37	.42	.34	.40
Gratton	.36	.36	.29	.36
King	.28	.32	.26	.31
Webster	.46	.52	.42	.50
Laguna Hondo	.36	.41	.33	.40
Rooftop	.59	.67	.54	.65
Other	.34	.39	.31	.38
Redding	.30	.34	.27	.33
Jefferson	.34	.39	.31	.38

variance was performed using several orders to test the effects, as was done with the pre-tests, because of the nonorthogonality of the design. When the learning-center effect was tested before the feeder-school effect, only the learning-center effect was significant. When the order was reversed, however, feeder schools were also found to be significantly different from each other ($p<.05$). These results indicate some confounding between independent variables. Multivariate F-tests of equality of mean vectors for both orders are reported in Table C.4. Given the pre-test findings that learning centers were significantly different on the four outcome measures at the beginning of the year, we felt it would be appropriate to adjust these initial discrepancies using analysis of covariance. Thus we used the model expressed in Eq. (2). The four dependent measures were

Table C.4

F-RATIOS OF MULTIVARIATE EQUALITY OF MEAN VECTORS ON POST-TEST SCORES

Item	Degrees of Freedom	F	p Less Than
Order 1			
Learning-Center Effect	16/550	2.87	.0002
Feeder-School Effect	52/699	1.26	.1068
Interaction	176/721	.96	.6397
Order 2			
Feeder-School Effect	52/699	1.39	.0403
Learning-Center Effect	16/550	2.46	.0014
Interaction	176/721	.96	.6398

post-test scores on reading, language, mathematics, and study skills. Covariates were pre-test scores on the same subtests. Means for unadjusted post-test grade-equivalent scores on the four outcome

measures summed over learning center and feeder schools are reported in Tables C.5 and C.6, respectively. Table C.7 reports standard deviations and variances for pre-test and post-test measures.

The regression analysis of pre-test scores on post-test scores showed that all pre-test measures significantly predicted post-test scores. A multivariate test of the hypothesis of no association between pre-tests and post-tests was significant ($F = 47.4$; $df = 16/538$; $p < .0001$). A canonical correlation analysis showed that the four pre-tests accounted for 36.7 percent of the variance in the four post-tests. A stepwise regression procedure demonstrated that each of the pre-tests was important to the prediction of the post-tests. Thus all predictor variables were found to be important and kept in the model.

The next step was to perform the analysis of covariance to see which independent variables were significant. Again several orders of testing independent variables were used. These showed that the learning-center effect was significant, but feeder schools and the interaction were not. However, when the feeder-school effect was tested first, the F value approached significance ($p < .07$) indicating that some confounding between effects may exist. Multivariate F values for the first order of testing are reported in Table C.8.

To gain some insight into differences between learning centers, it was decided to estimate a new model which contained the general mean, learning-center effect, the covariates, and an error term. The least-squares estimates adjusted for covariates are reported in Table C.9. These are to be interpreted in the same fashion as the least-squares estimates for pre-test scores reported previously. Inspection of the least-squares estimates points to a striking and non-intuitive finding. The least-squares estimates for Learning Centers 1 through 4 are generally negative, indicating that when we adjust post-test scores and compare these learning centers to Learning Centers 5 and 6 (combined), Learning Centers 1 through 4 have not gained as much academically as those in Learning Center 5/6. Looking at the pre-test, we would have thought that Learning Center 5/6 would be below Learning Centers 1 and 2 on the post-test. Furthermore, had we

Table C.5

LEARNING-CENTER OBSERVED POST-TEST MEANS
SUMMED OVER FEEDER SCHOOLS

Learning Center	N	Reading	Language	Mathematics	Study Skills
1	65	6.19	6.33	6.47	6.86
2	79	6.44	6.70	6.39	7.11
3	29	5.04	5.23	5.85	5.94
4	21	5.45	5.17	5.76	5.59
5	51	6.49	5.86	5.95	6.81

Table C.6

FEEDER-SCHOOL OBSERVED POST-TEST MEANS
SUMMED OVER LEARNING CENTERS

Feeder School	N	Reading	Language	Mathematics	Study Skills
Filipino Educational Center	10	4.67	5.47	6.05	5.48
Unknown	14	6.37	5.98	5.75	6.59
Carmichael	37	5.81	5.89	6.15	6.30
Henry	10	6.76	7.93	6.78	7.59
Clarendon	16	6.43	6.84	6.48	7.50
Gratton	22	7.13	7.31	6.98	8.14
King	30	6.21	6.29	6.55	7.20
Webster	10	4.86	4.56	5.71	5.83
Laguna Hondo	17	6.63	6.05	5.97	6.56
Rooftop	6	6.27	6.10	5.60	6.63
Other	19	6.14	6.01	6.10	6.82
Redding	27	6.24	5.81	6.20	6.53
Jefferson	19	5.95	5.70	5.90	6.03
Edison	14	5.16	5.11	5.25	5.46

Table C.7

VARIANCE AND STANDARD DEVIATIONS ON
PRE- AND POST-TEST MEASURES

Area	Pre-Test		Post-Test	
	Variance	S. D.	Variance	S. D.
Reading	2.32	1.52	3.45	1.86
Language	2.93	1.71	3.93	1.98
Mathematics	1.90	1.38	2.41	1.55
Study Skills	2.77	1.66	5.20	2.28

Table C.8

F-RATIOS OF MULTIVARIATE EQUALITY OF MEAN VECTORS
ON POST-TEST SCORES USING PRE-TESTS AS COVARIATES

Source	Degrees of Freedom	F	p Less Than
Learning-Center Effect	16/538	5.94	.0001
Feeder-School Effect	52/684	0.99	.4992
Interaction	176/705	0.86	.8891

Table C.9

LEAST-SQUARES ESTIMATES OF EFFECTS FOR POST-TEST SCORES
ADJUSTING FOR COVARIATES FITTING A MODEL OF RANK FIVE

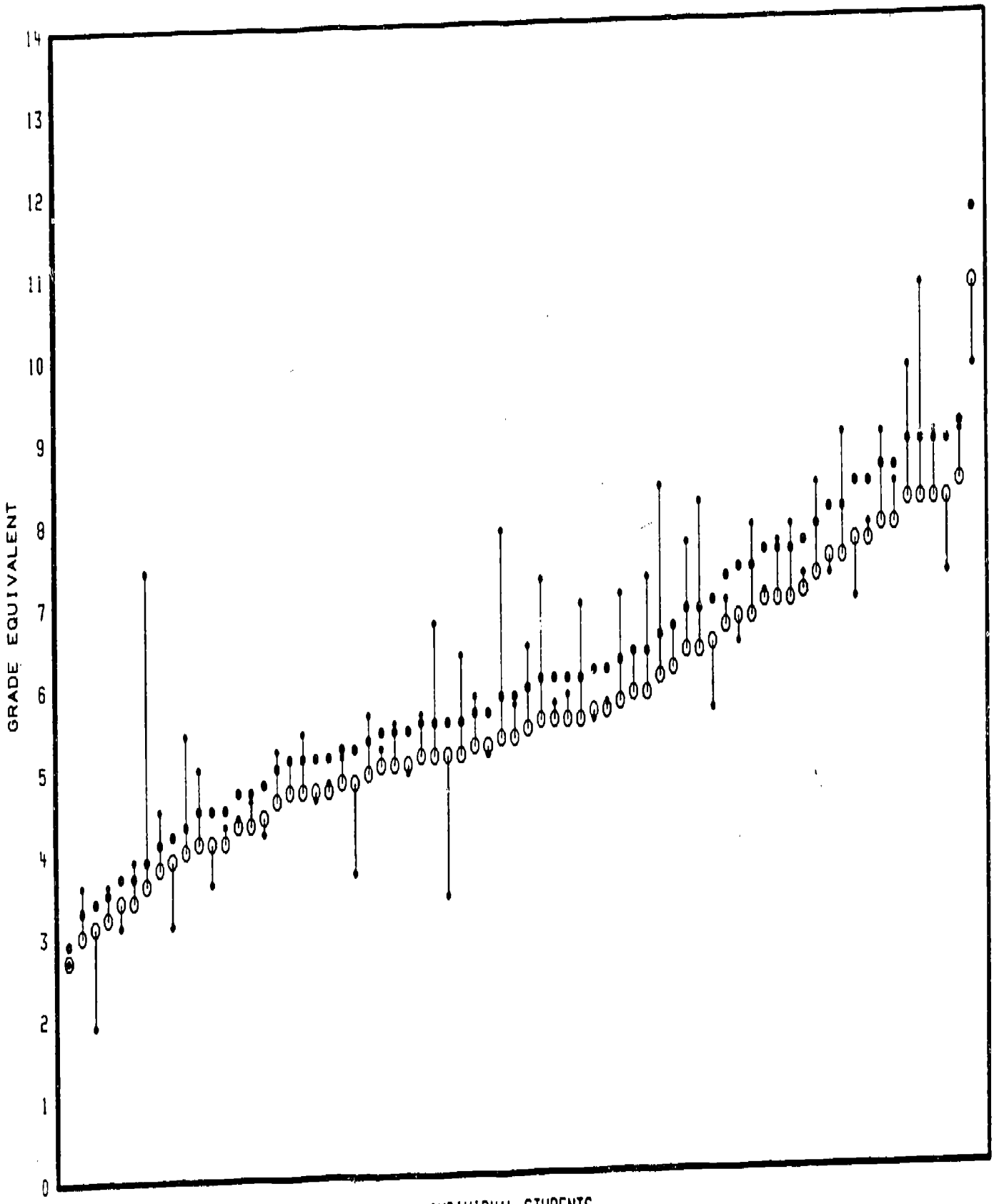
Item	Reading	Language	Mathematics	Study Skills
General Mean	- .05	- .24	1.06	- .22
Learning Center 1	-1.23	- .58	- .17	- .93
Learning Center 2	-1.25	- .54	- .48	-1.18
Learning Center 3	- .77	.02	.38	- .08
Learning Center 4	-1.15	- .94	- .60	-1.59

looked at post-test least-squares estimates using only the post-test and not adjusting for the pre-test, the general impression would have been one of no gain on the part of Learning Center 5/6 over Learning Centers 1 and 2.

In summary, then, the analysis of post-test scores tended to indicate that both feeder school and learning centers produced significantly different scholastic outcomes. But when we controlled for initial disparities in adademic achievement as measured by pre-test, we found that only learning centers affected post scores. Least-squares estimates tended to show that most learning centers were performing below Learning Center 5/6 (combined) on the four outcome measures.

Appendix D

STUDENT IDIOGRAPHS FOR READING



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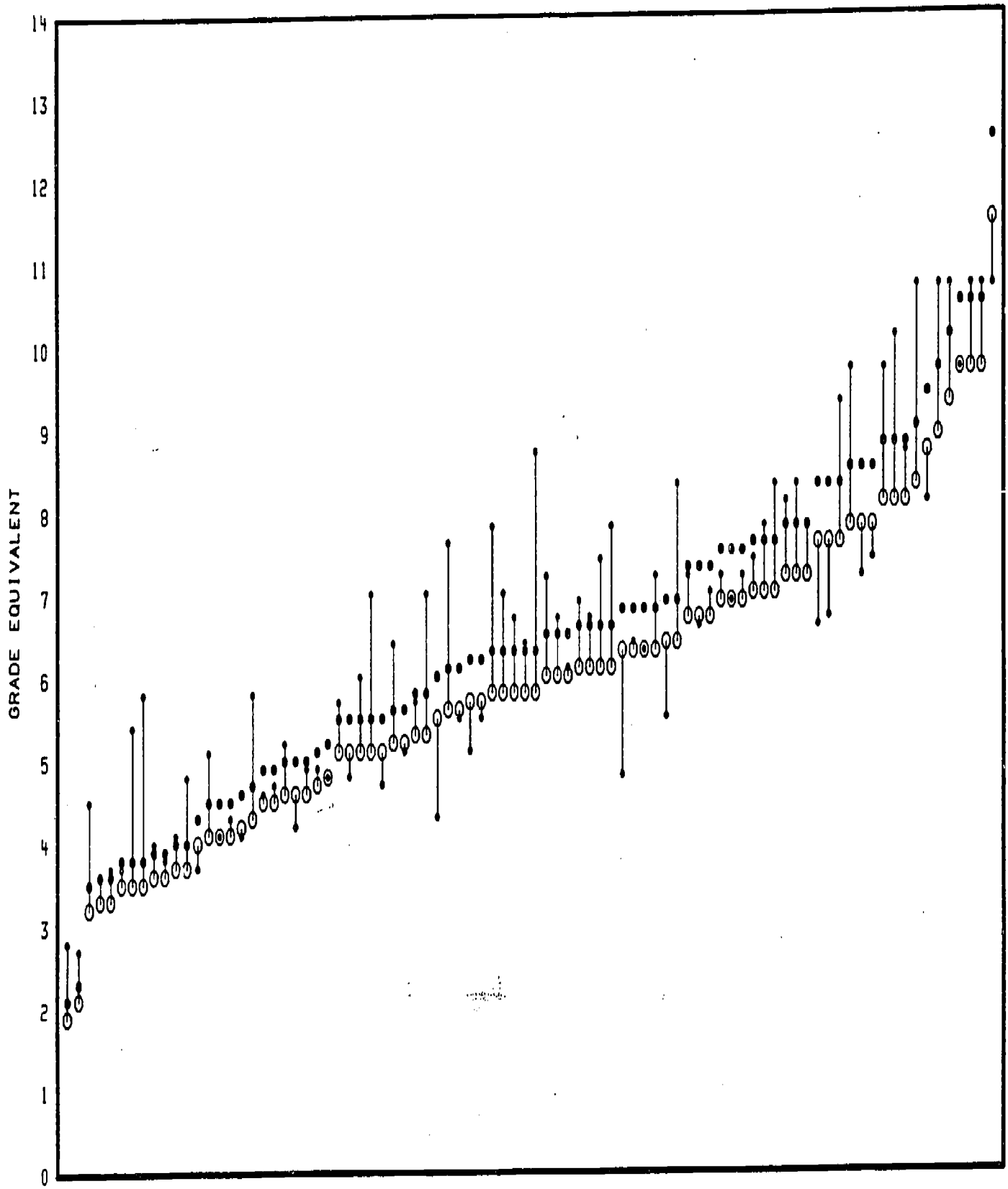

INDIVIDUAL STUDENTS

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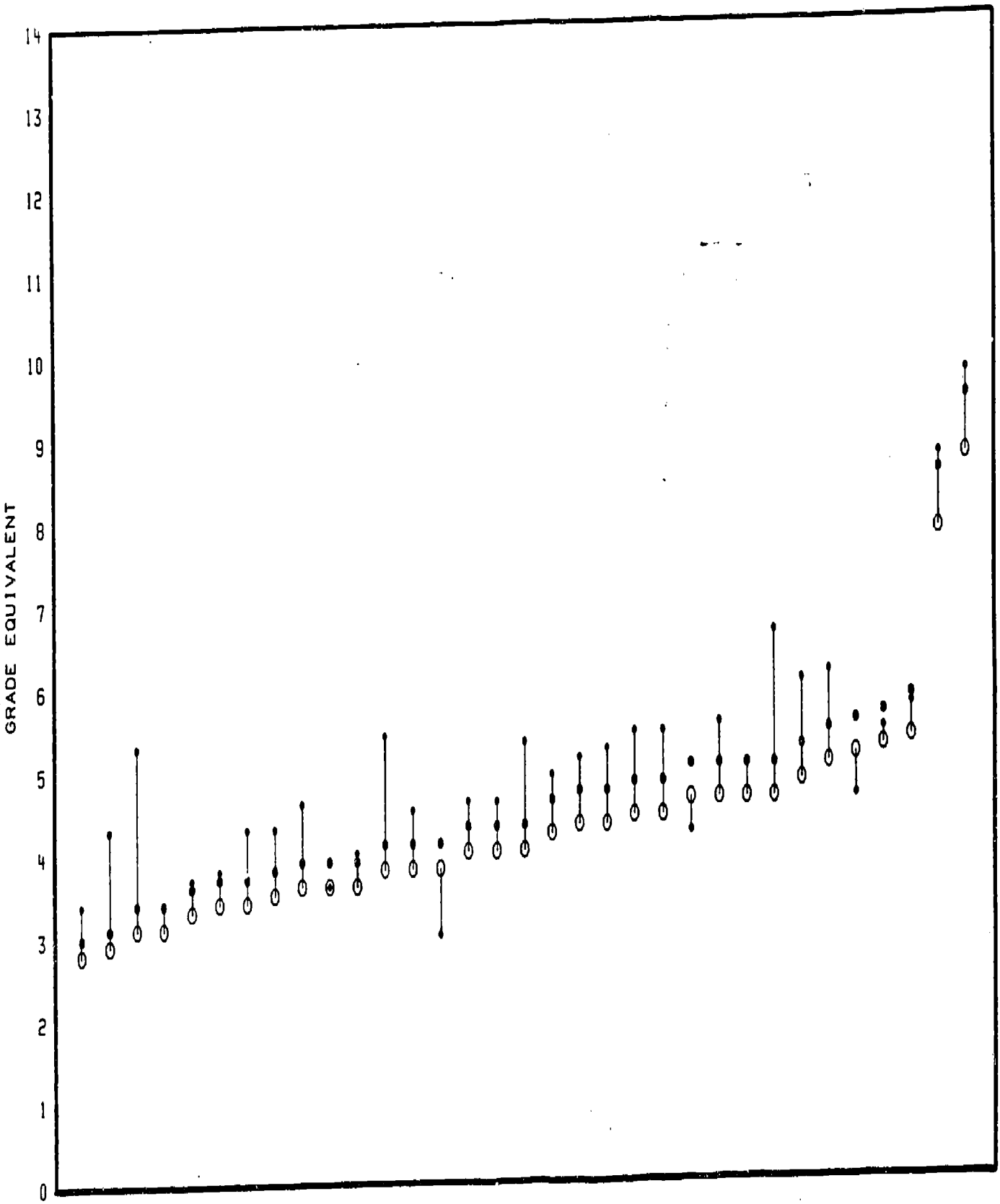

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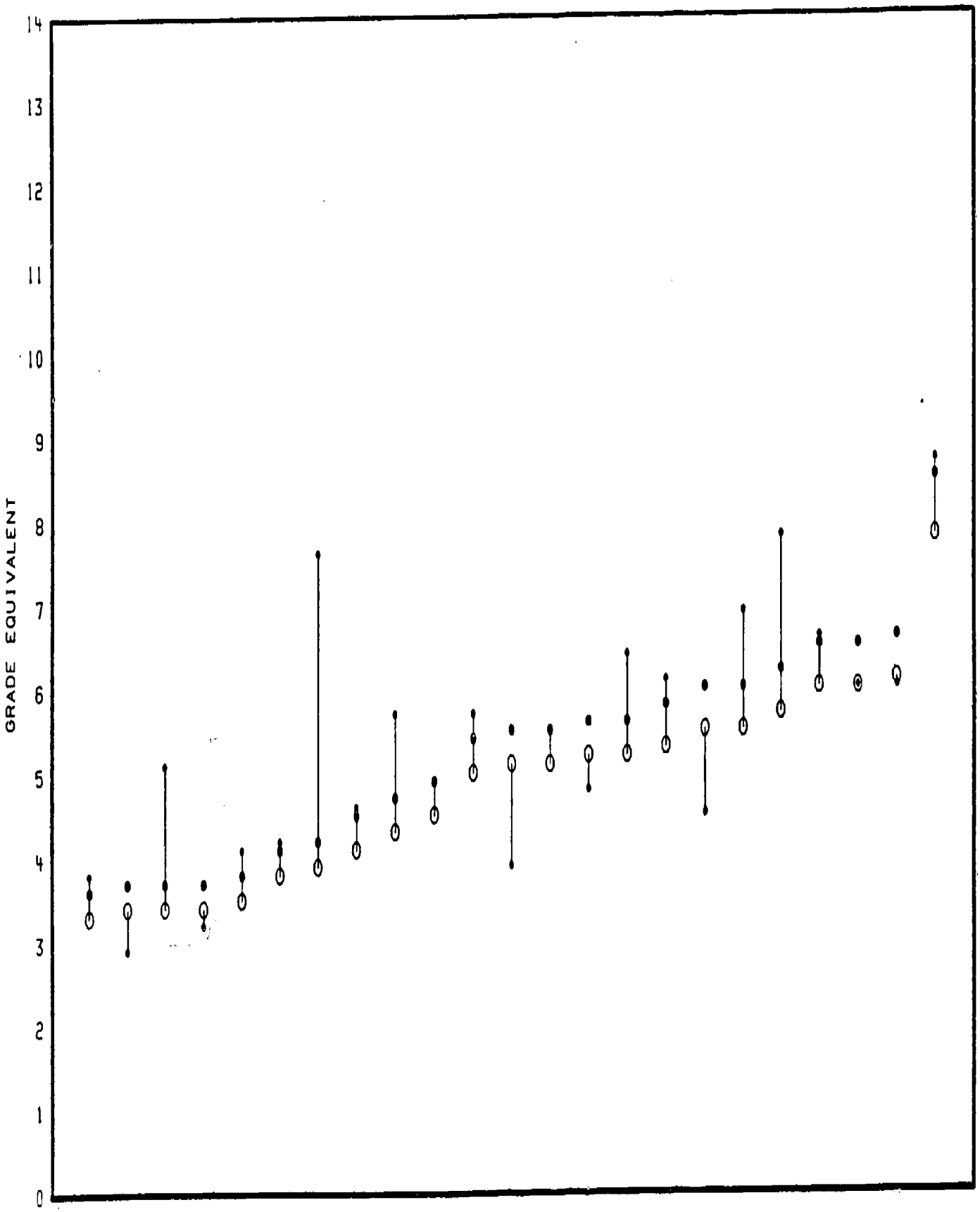

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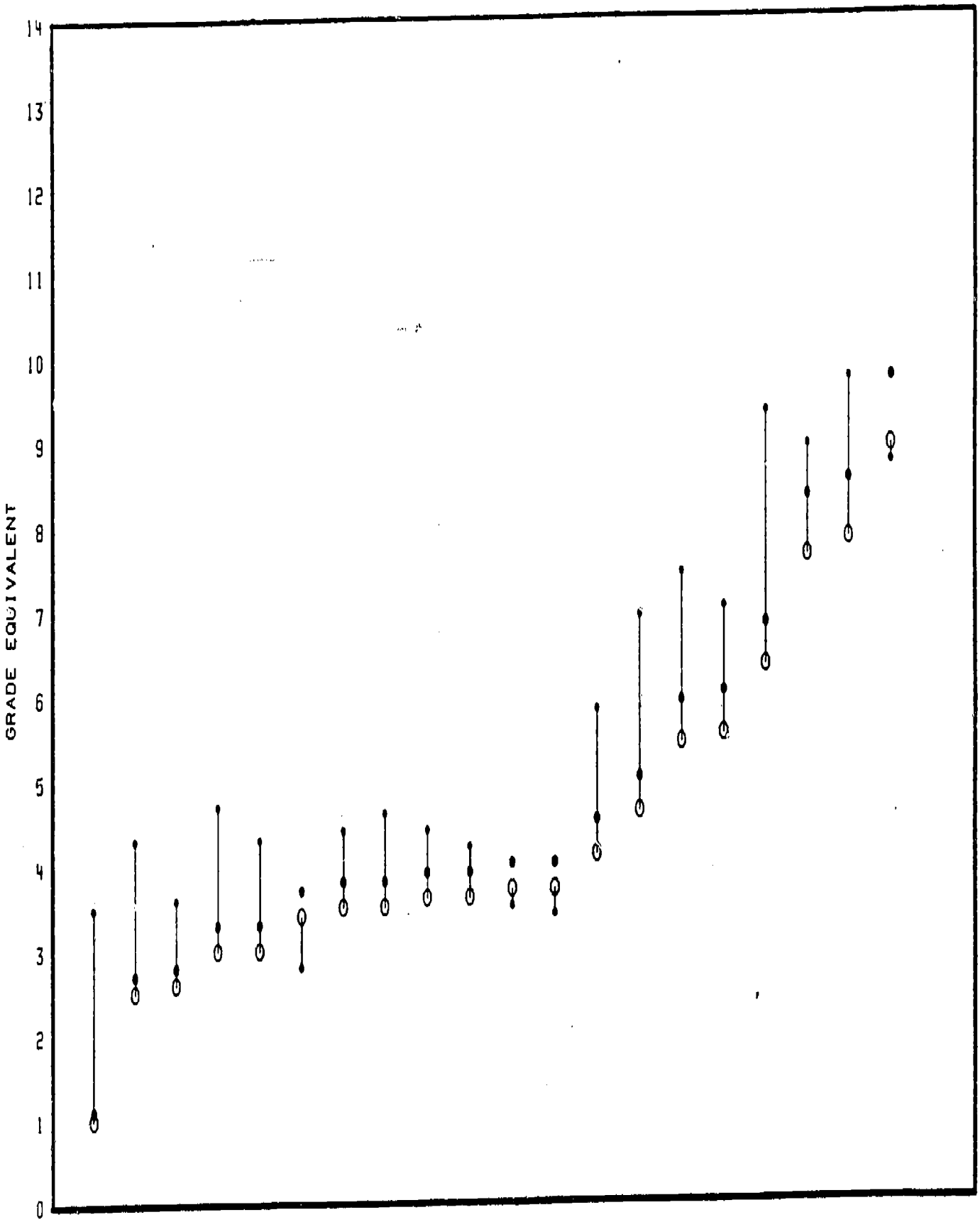

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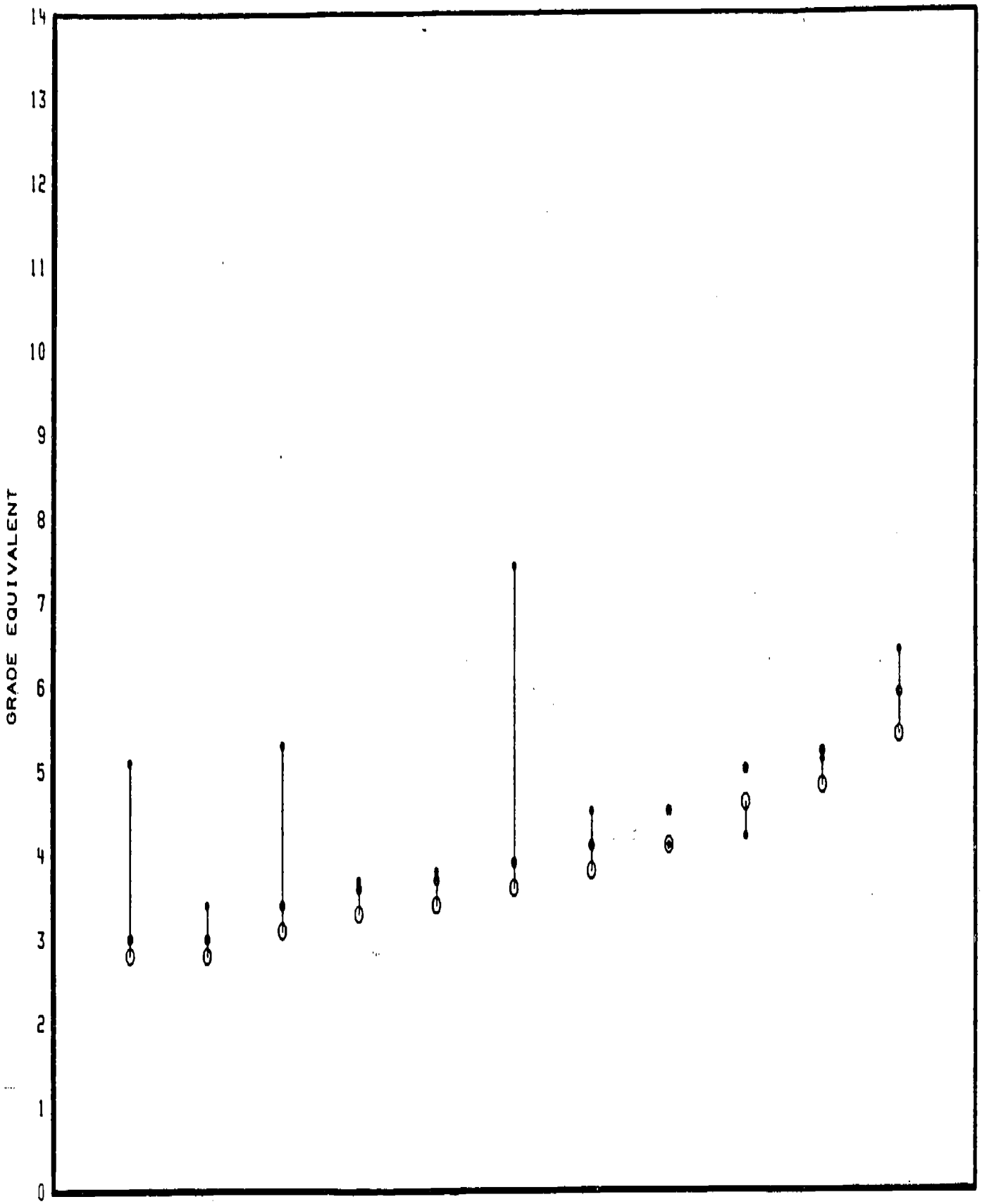

INDIVIDUAL STUDENTS BY FEEDER SCHOOL

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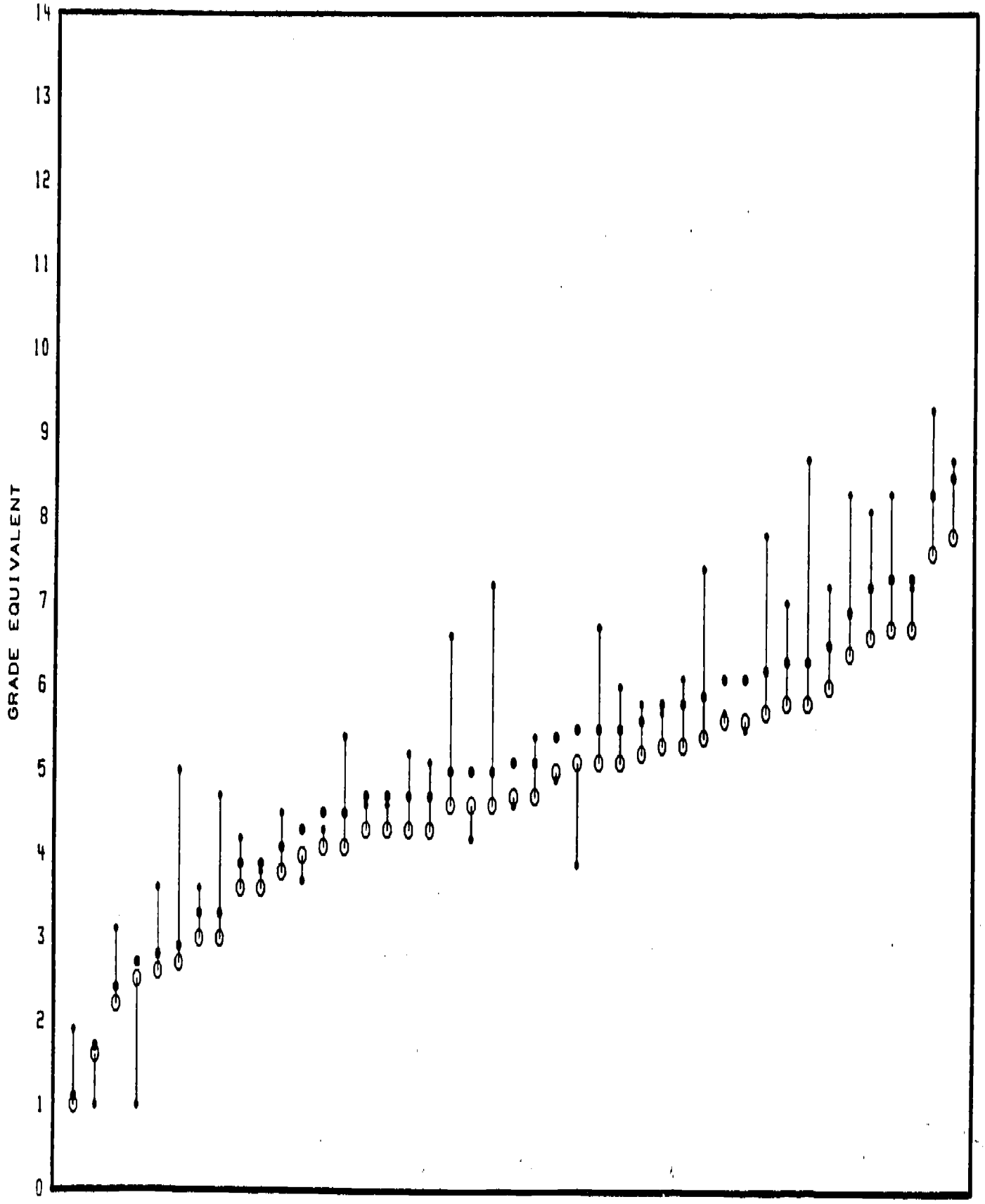

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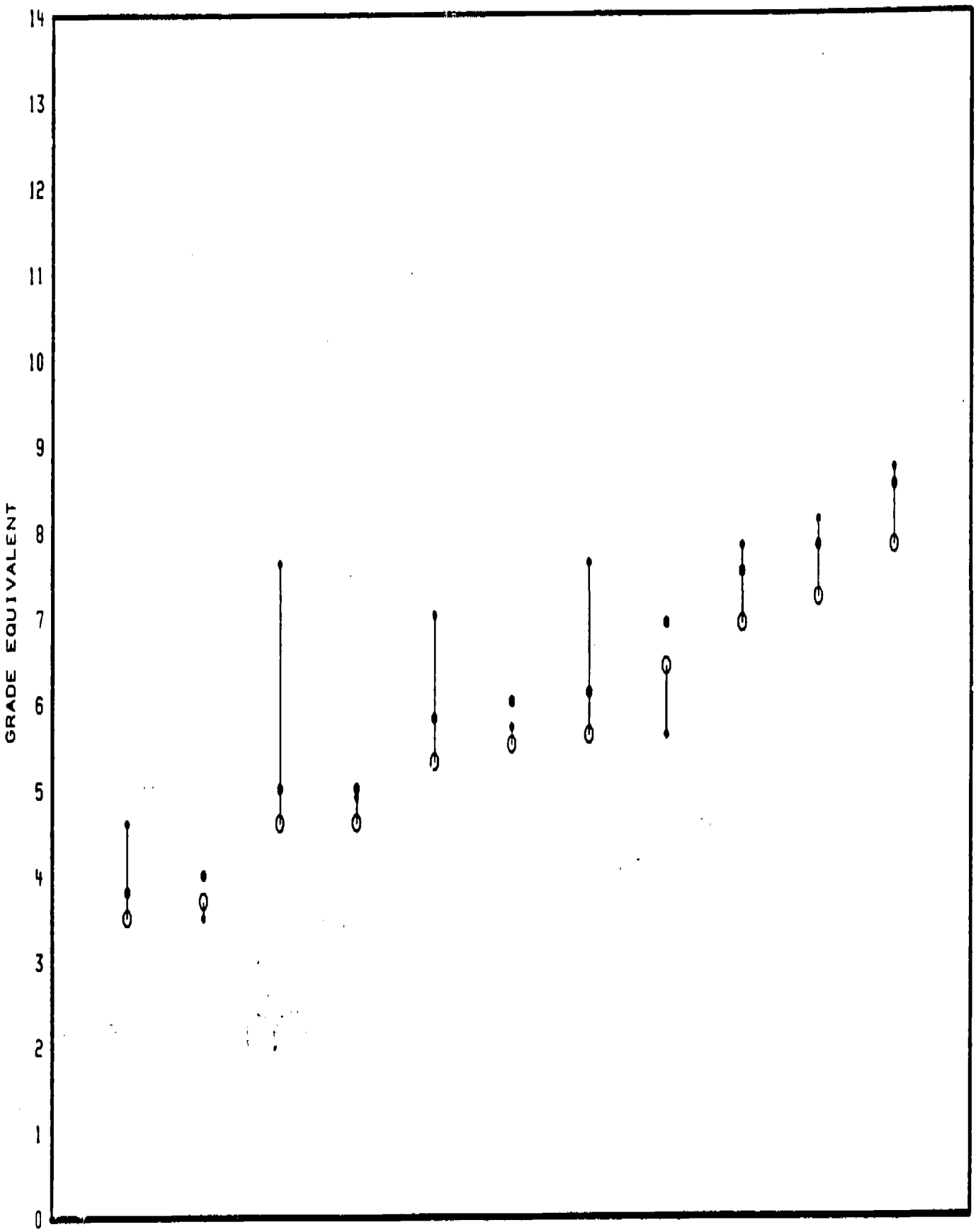
7TH GRADE READING SCORES CARMICHAEL



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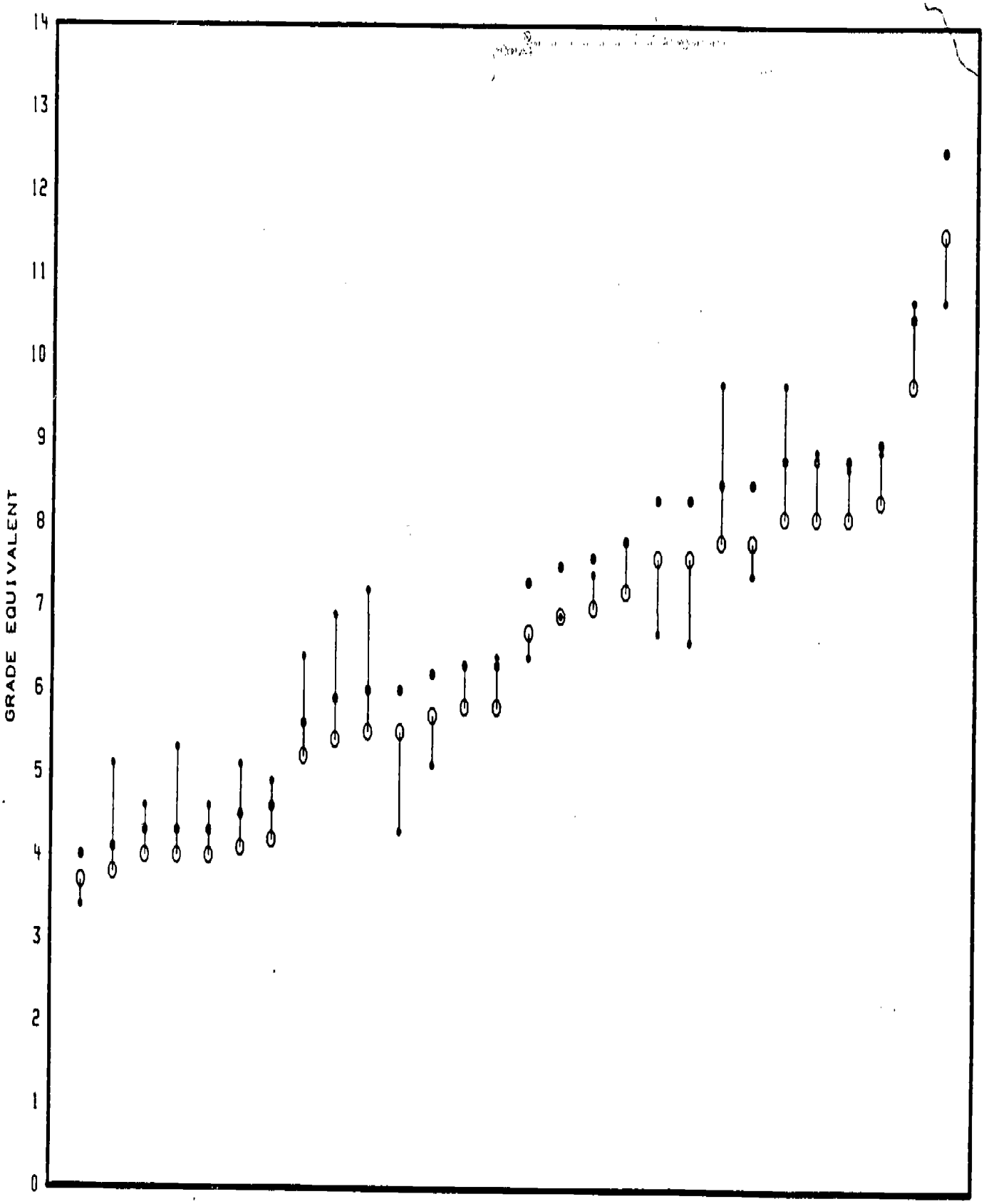

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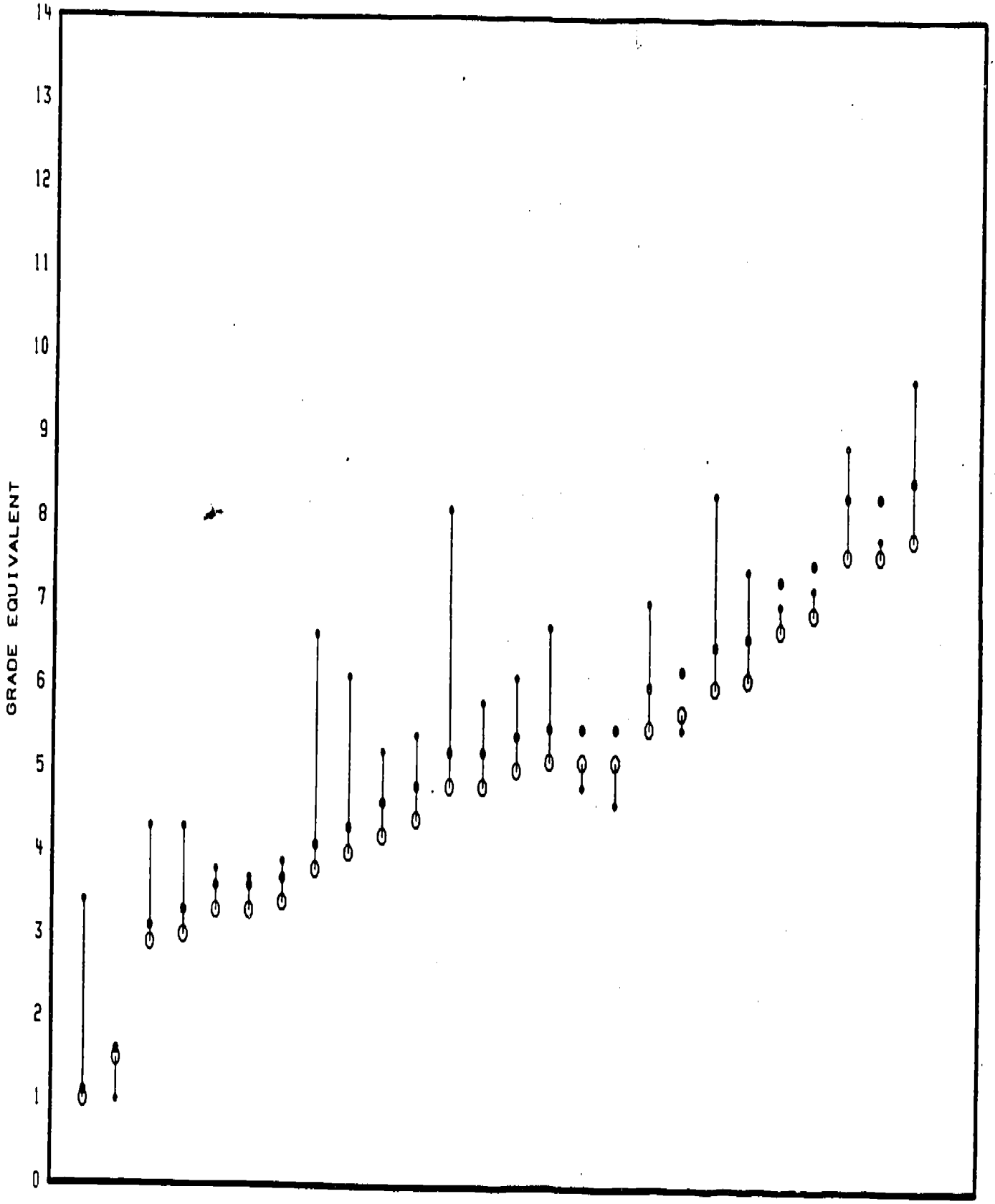

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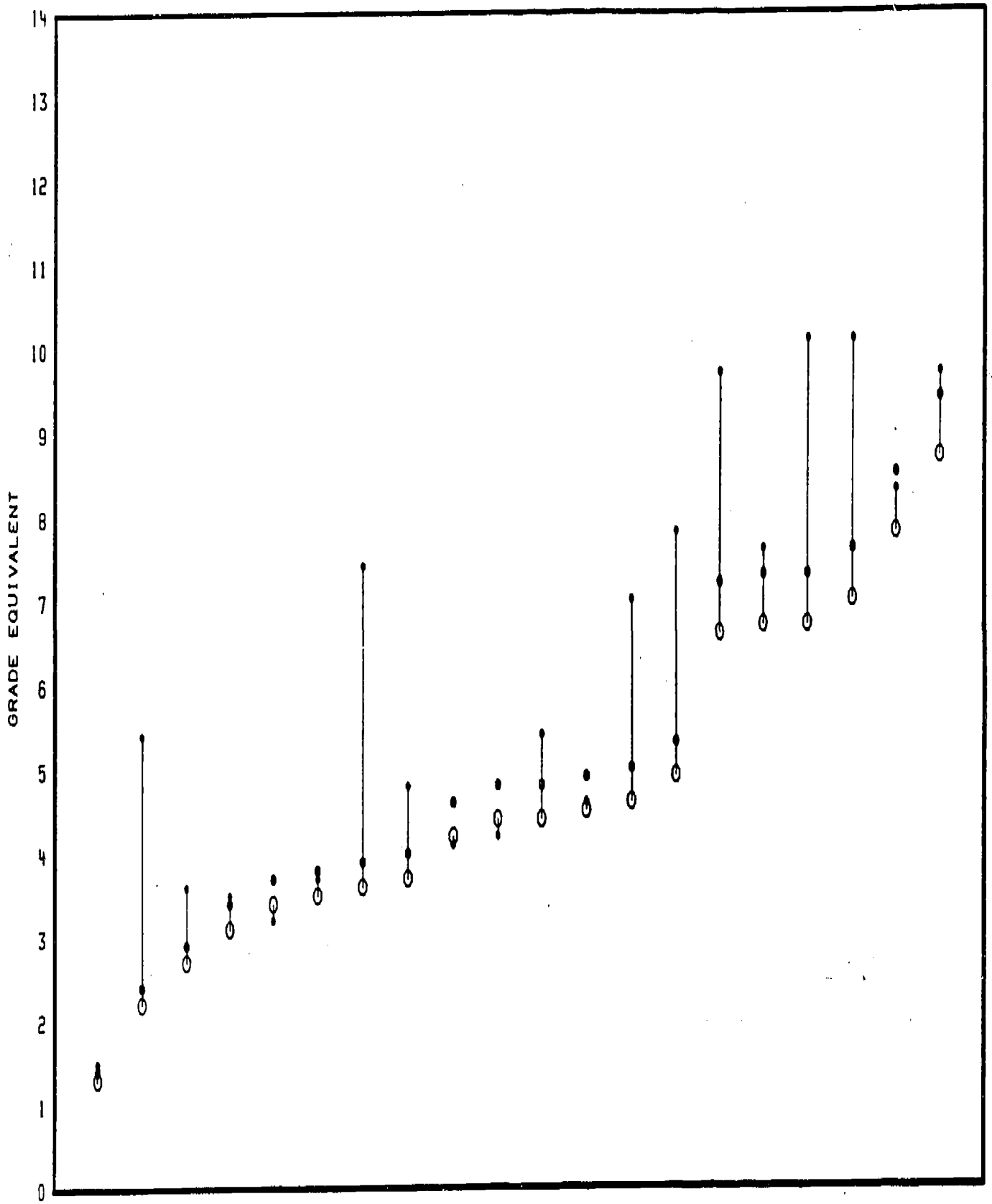

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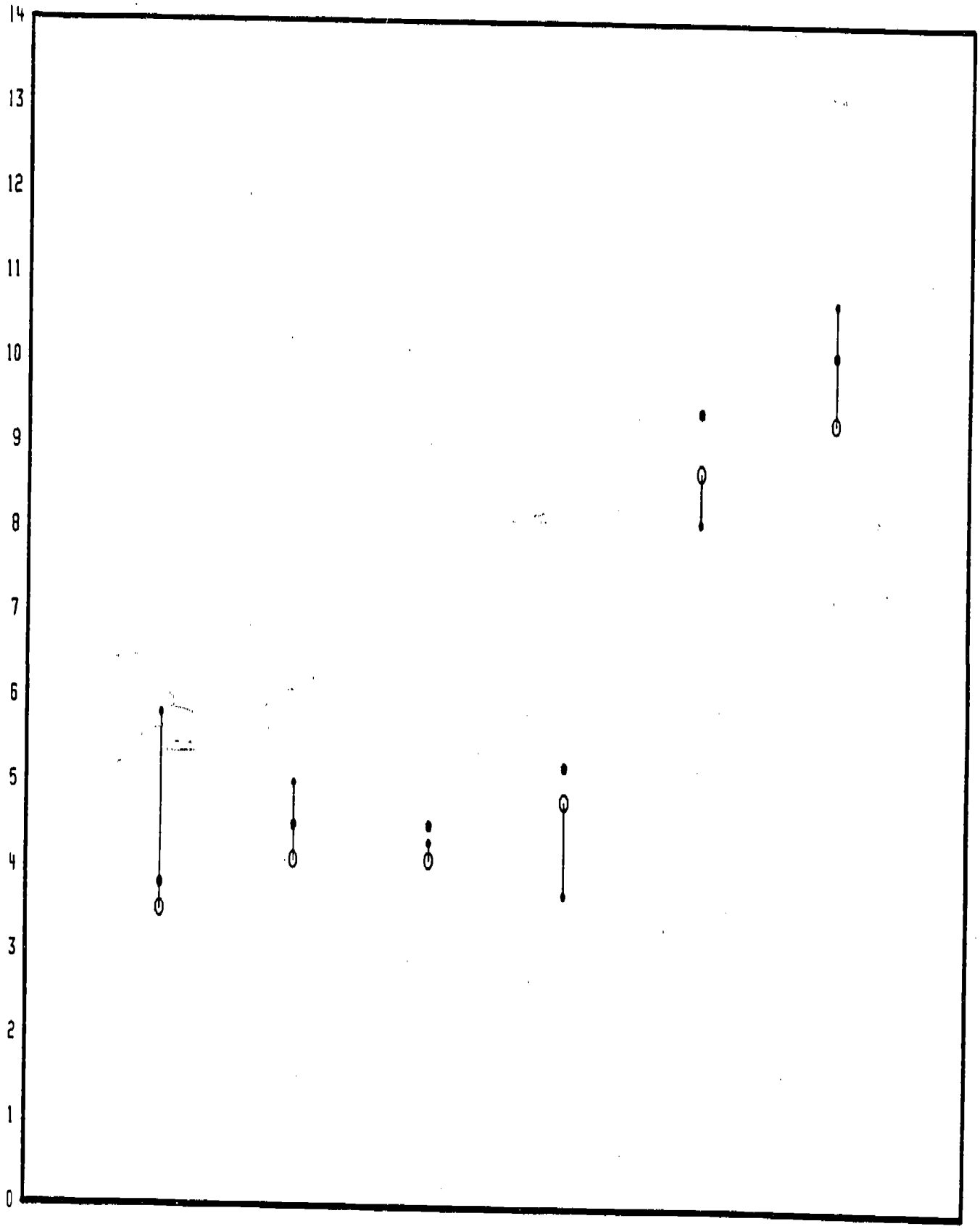

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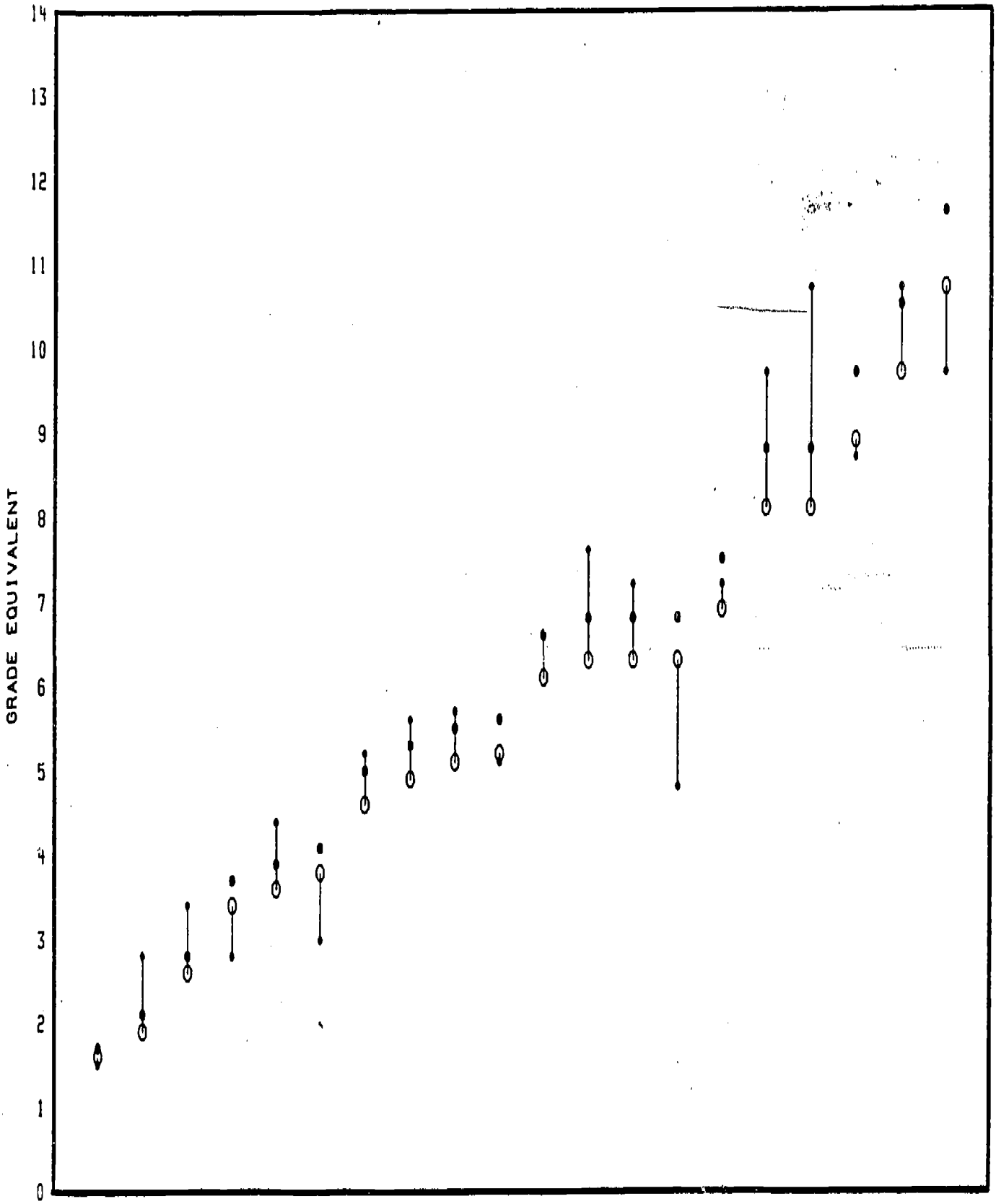
7TH GRADE READING SCORES ROOFTOP



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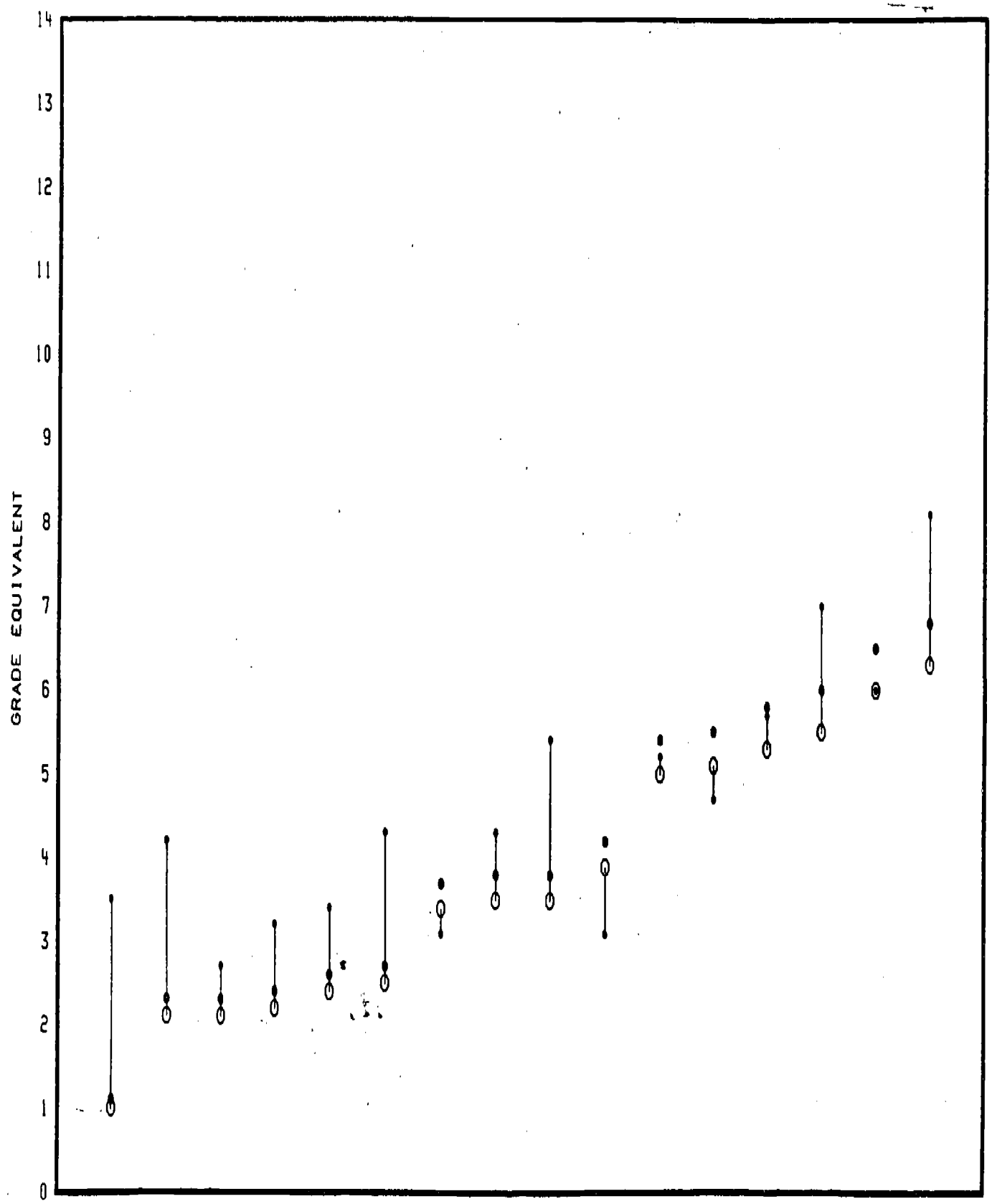

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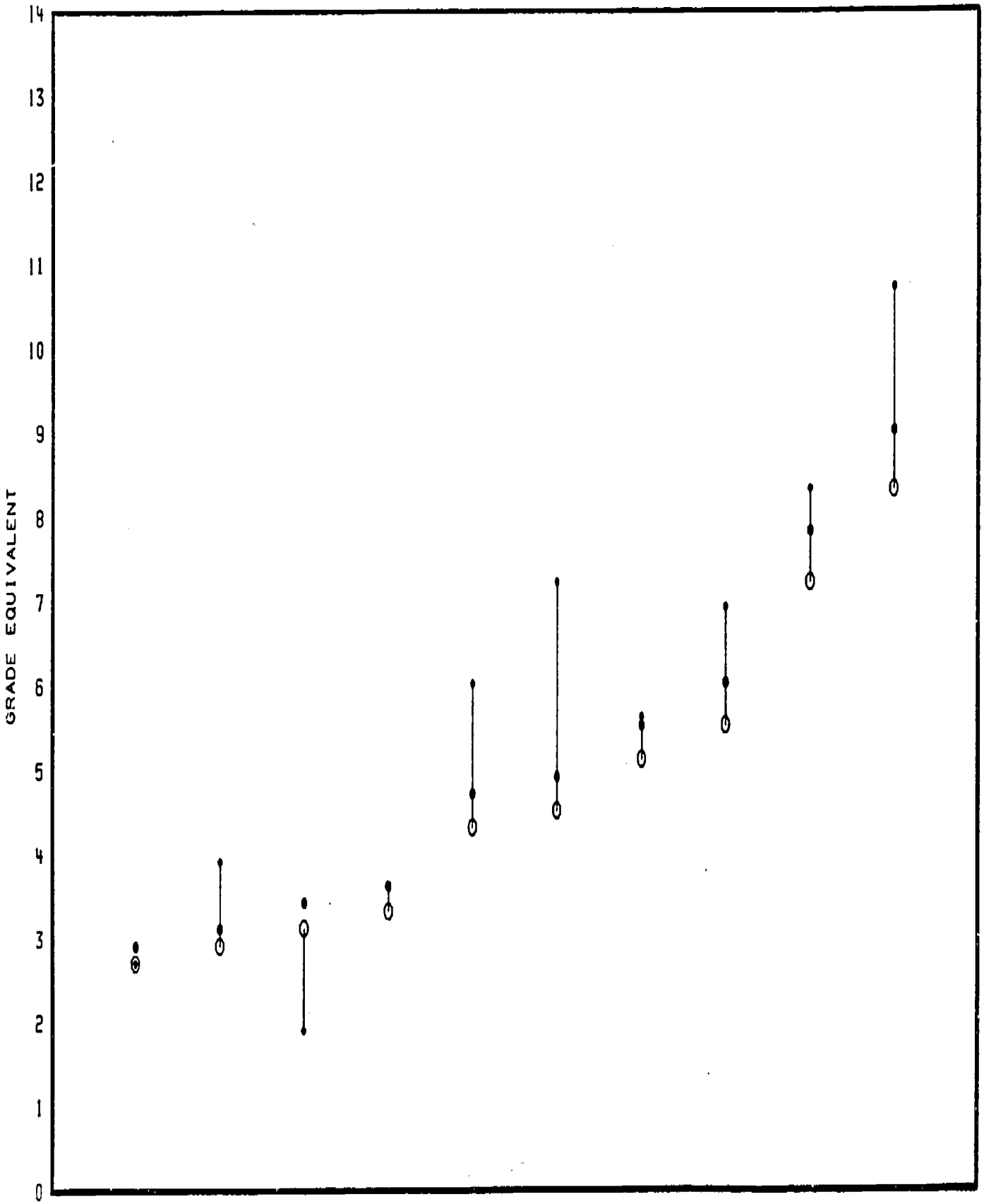
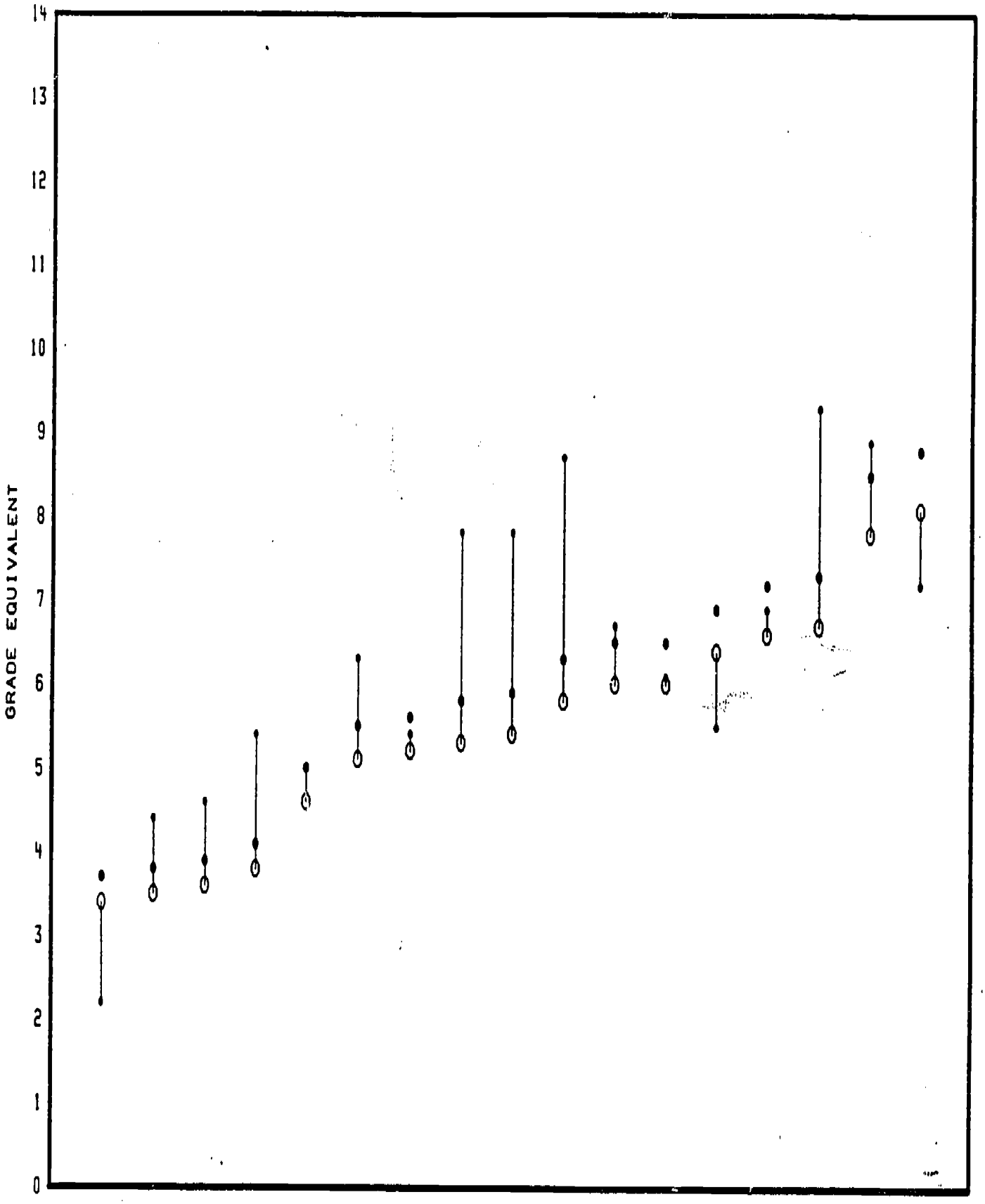
7TH GRADE READING SCORES WEBSTER



INDIVIDUAL STUDENTS BY FEEDER SCHOOL

7TH GRADE READING SCORES EDISON SCHOOL



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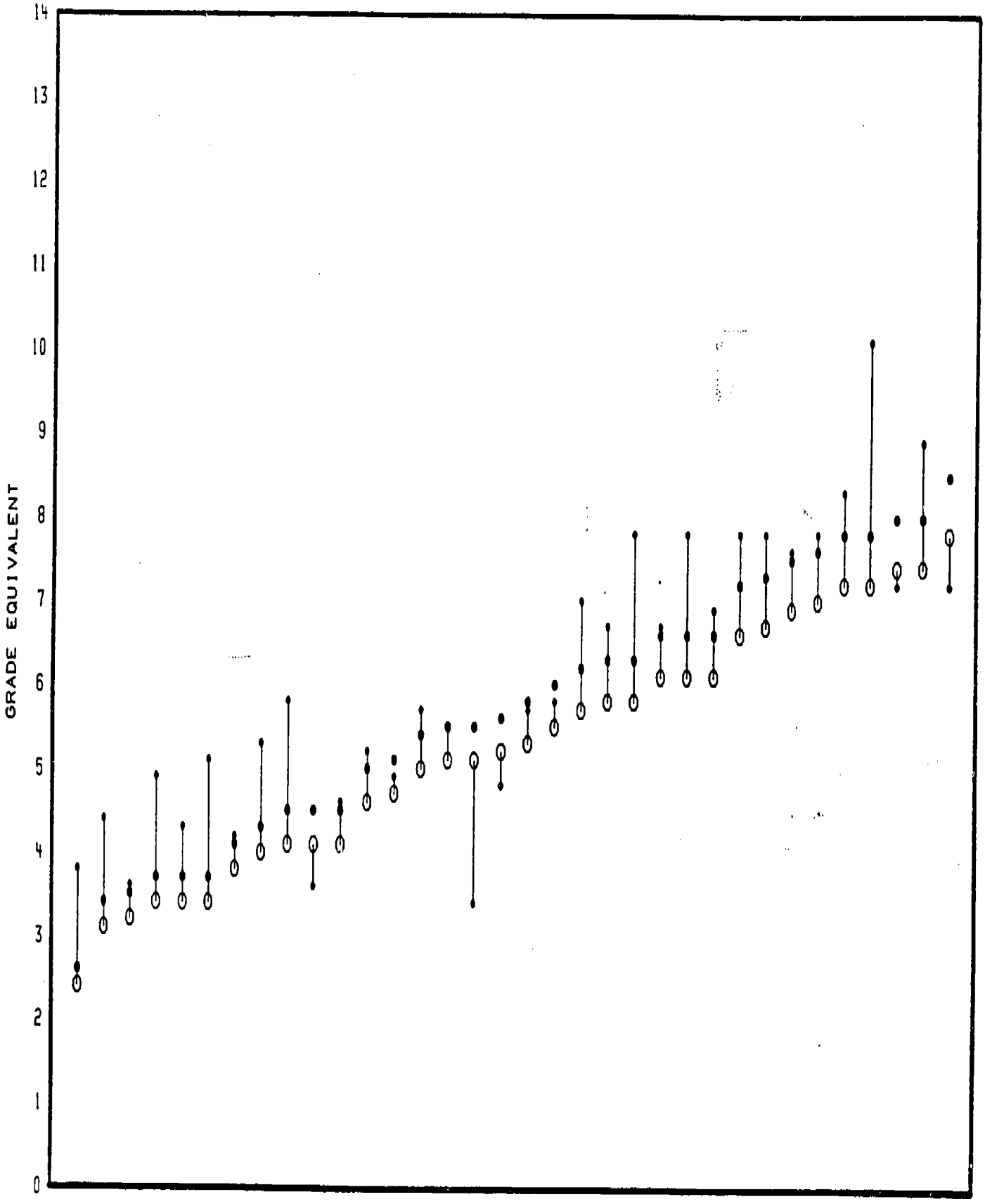

INDIVIDUAL STUDENTS BY FEEDER SCHOOL

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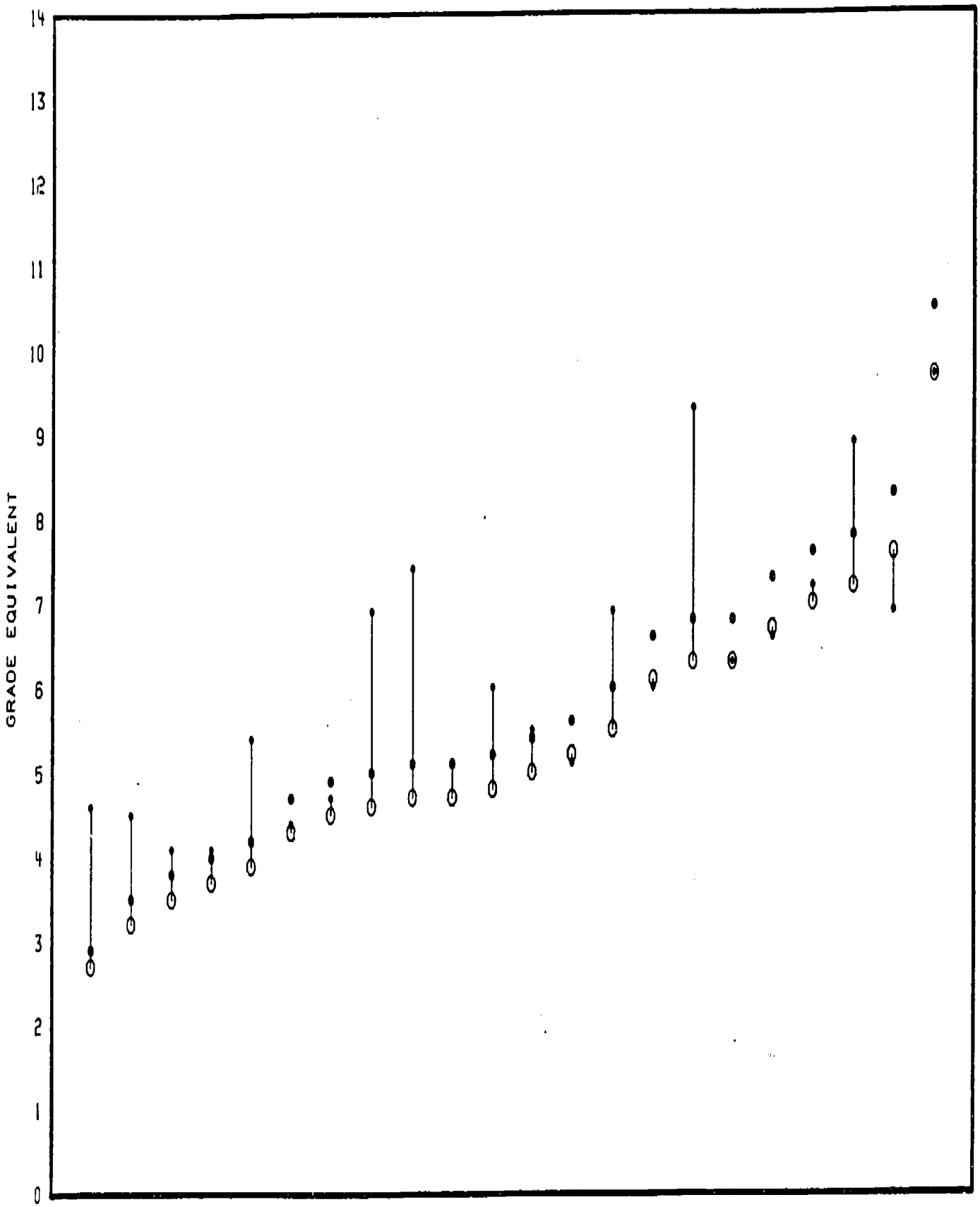

INDIVIDUAL STUDENTS BY FEEDER SCHOOL

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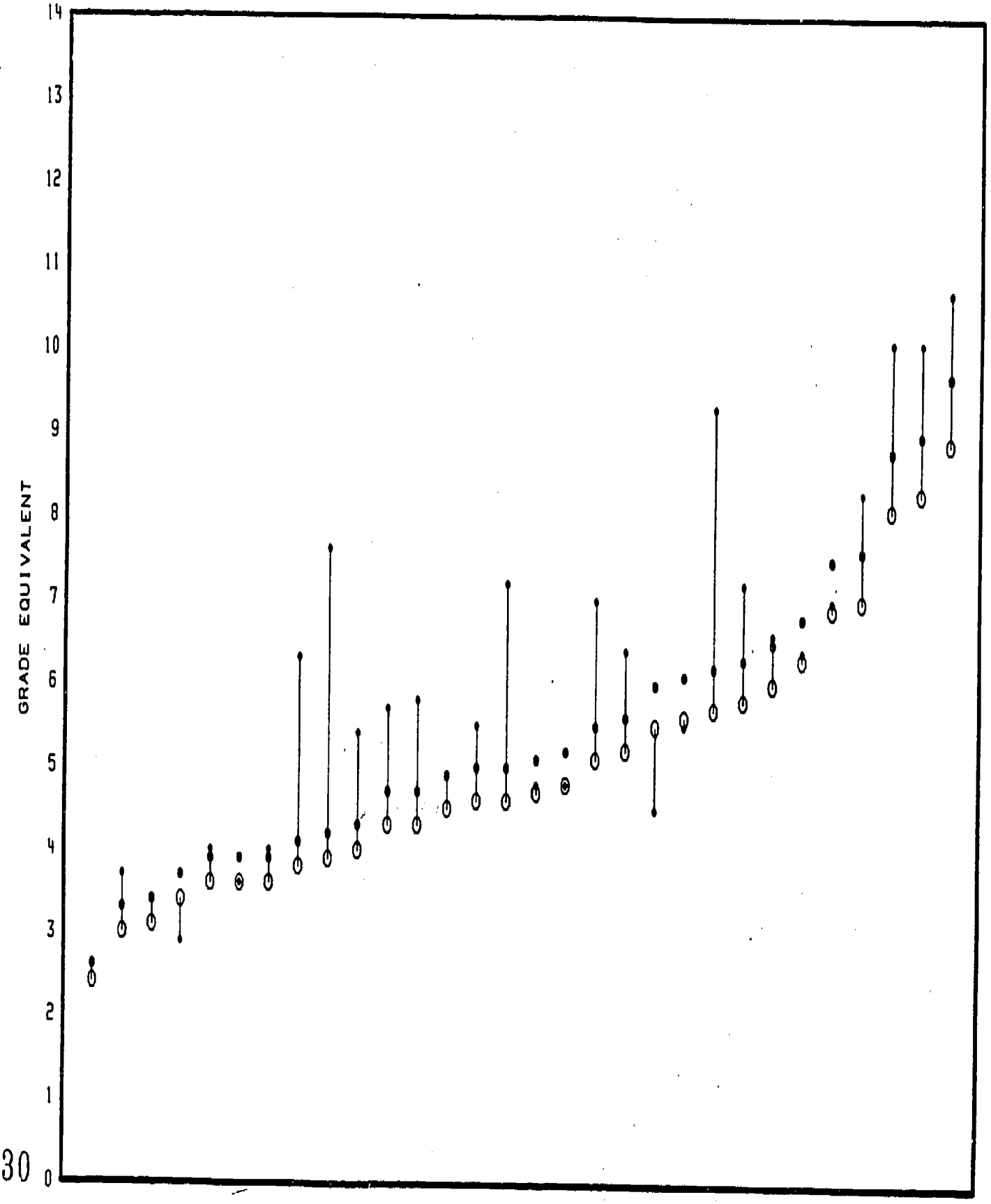

INDIVIDUAL STUDENTS BY FEEDER SCHOOL

7TH GRADE READING SCORES REDDING